EXPLORING RESILIENCE ENGINEERING THROUGH THE PRESCRIPTION AND PRACTICE OF SAFE WORK METHOD STATEMENTS IN THE VICTORIAN CONSTRUCTION INDUSTRY

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Statement of Authorship

Except where explicit reference is made in the text of this thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis for which I have qualified for or awarded another degree or diploma. No other person's work has been relied upon or used without due acknowledgement in the main text and the reference list of the thesis.

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ABSTRACT

This study investigated whether safe work method statements (SWMS) enhance or hinder resilience engineering (RE) as a health and safety management strategy in the Victorian construction industry. It is an important study because SWMS have been legislated by the federal and state governments as a fundamental risk control strategy for high-risk construction work; yet there is little empirical evidence to support this policy decision. Research on safety rules and procedures (to which SWMS can be associated) suggests they are not followed to the letter but adapted to suit context, and this adaptation is an important aspect of RE, a recent innovation in health and safety management.

The research design follows constructivist epistemology and a theoretical framework of symbolic interactionism. The methodological approach used is quite extensive, if not innovative. Instead of examining SWMS within a single, linear system, I have extended the research to include multiple levels that constitutes the broad construction socio-technical system. Three research sites, including two domestic housing and one commercial construction projects located in Victoria, Australia, provided the context of my cases.

The results show that SWMS are expected to achieve multiple objectives across the socio-technical system. For example, from the point of the view of the three organisations, SWMS as prescribed are expected to provide legal protection, are a process for achieving efficiency, assessing risks and tasks, and a tool for planning, auditing and enforcing. These objectives, to a large extent appear to differ from the regulator, but align more closely to that of the association. In a similar manner, SWMS as practised are also expected to provide legal protection, involve a process, and a tool for planning and thinking about work. SWMS are also expected to bring about safety as (i) a set of procedures and/or rules, (ii) a process, (iii) a tool for creating awareness, and (iv) a tool for social interactions.

The different views across the construction socio-technical system suggest three main types of gaps exist, that of (i) perspectives, (ii) strategies, and (iii) communication, and these make the system brittle. A number of strategies already exist across the three organisations, including monitoring, reviews, and a unique view of SWMS as a cognitive artefact. The work described in this thesis strongly suggests that such flexibility, supported with social interactions and double-loop learning, are opportunities that can be used enhance RE in the Victorian construction industry.

The study has a number of limitations. First, the findings are based on two domestic and one commercial construction organisations, so the results may not be readily generalised to other sites, across the construction sector in Victoria or Australia. Second, there was an uneven distribution of informants from across the three organisations, and at different levels investigated. Third, at the time of data collection harmonised health and safety laws, including those affecting SWMS and construction were being rolled out, and this could have influenced the results. Fourth, only I was the one who collected and analysed the data, so the themes I have chosen to write about are a reflection of my biases as a novice, qualitative researcher. And fifth, the lapse in time between data collection, analysis, and writing up of this thesis could well mean that some of the views held by the informants may not be relevant now.

Notwithstanding these limitations, this thesis makes a number of significant contributions.

First, it provides empirical evidence of the way in which SWMS are interpreted by managers, supervisors and workers in three construction organisations, and the assumptions upon which they are based. Second, it extends the research on SWMS and construction health and safety by including data from contractors and subcontractors, who form an integral part of Australia's construction system. Third, it adds to the literature on RE literature from the construction sector; in doing so it seeks to broaden the reach of RE to traditional industries. Fourth, it provides empirical evidence of the utility of the socio-technical and Prescriptions–Repetitions–Distinctions–Descriptions (PRDD) framework for examining the gap between work as imagined and work as performed. And fifth, it adds to the knowledge base on social construction of safety on construction sites.

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Peer Reviewed Publications and Conference Presentations

The following peer reviewed publications and conference presentations are associated with this research:

Publications

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Glossary

ABCC	Australian building and construction commission
ASCC	Australian safety and compensation council
CAIB	Columbia accident investigation board
CAIR	Checklist for assessing institutional resilience
CBAs	Controlled before-and-after studies
CCF	Civil contractors federation
CFMEU	Construction, forestry, mining and energy union
COP	Code of practice
DHRW	Designated high-risk work
DISC	Dimensions of integrated safety culture
FSC	Federal safety commissioner
GDP	Gross domestic product
GVA	Gross value add
HIA	Housing industry association
HSE	Health and safety executive
HSMS	Health and safety management system
HSR	Health and safety representative
IGA	Intergovernmental agreement
JSA	Job safety analysis
MBAV	Master builders association (Victoria division)

MOU	Memorandum of understanding
MPA	Master plumbers association
NOHSC	National occupational health and safety commission
OHS	Occupational health and safety
PCBU	Person in control of building or undertaking
PPCE	Personal protective clothing and equipment
PPE	Personal protective clothing
PRDD	Prescriptions–repetitions–distinctions–descriptions cycle
RCT	Randomised controlled trials
RE	Resilience engineering
REA	Resilience engineering association
RTM	Roof tiling machine
RTO	Registered training organisation
SI	Symbolic interactionism
SRK	Skills-rule-knowledge
SWA	Safe Work Australia
SWMS	Safe work method statement
TAFE	Technical and further education
UB	University of Ballarat
VCSA	Victorian construction safety alliance
VVHBSA	Victorian volume home builders safety alliance

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CHAPTER 1: INTRODUCTION

1.0 PREAMBLE

This thesis investigates whether safe work method statements (SWMS) impede or enhance resilience engineering (RE), by exploring the dialectic between prescription and practice of SWMS. It is based on three cases studies in the Victorian construction industry.

There are a number of reasons behind this research. SWMS were introduced as a strategy for controlling health and safety risks in construction as part of National Standard for Construction Work, and adopted in Victoria as part of the consolidated Occupational Health and Safety Regulations 2007. They have also been retained in the Model Work Health and Safety Regulations 2011 as part of the harmonisation of health and safety laws.

However, as a health and safety professional I have a firm conviction that Victoria already has a relatively mature performance-based health and safety legislation; in some ways going beyond Roben's through 'mega-regulations' in the form of safety cases and safety management systems (Gunningham, 2006, 2007), a conviction reinforced through my experience as a health and safety inspector in the state. So why were the regulators proposing a return to more traditional prescriptions? Because for me this is exactly what SWMS represented: a set of prescriptions, in the form of policies, procedures, or rules; part of traditional approach and which had already proven to be ineffective in the past.

As I delved more and my interest grew, an opportunity presented itself in the form of RE as an innovation in health and safety management. In particular, the notion of the gap between work as imagined and work as performed as an important tenet of RE sounded fascinating. How could this gap be investigated using SWMS and what could RE offer to construction in terms of improving its health and safety performance? These were the crucial moments in my thinking that later served as the start of this exciting research journey.

The rest of this chapter provides an introduction to the thesis through a brief review of health and safety and its management in construction. The research problem, the purpose and importance of my study and research questions that I set out to ask is included in this chapter. The final section provides a chapter by chapter outline of the whole thesis.

1.1 BACKGROUND AND CONTEXT

Every day, approximately a million workers are injured at work, and over five thousand people die from work-related diseases (Hämäläinen, Leena, & Takala, 2009). In Australia more than 53 workers out of every 1000 employed experienced work-related injuries and diseases in 2010 (Australian Bureau of Statistics, 2010), placing high economic burdens on a nation. The direct costs of work-related injuries exceeded $57B (Australian Safety and Compensation Council (ASCC), 2009). Coupled with this are indirect social costs, all of which are expected to rise as we face further challenges from rapid technological changes (Leveson, Dulac, Marais, & Carroll, 2009), changing nature of hazards and risks, changing societies views of accidents, introduction of new regulations, and increasing complexity of organisations (Leveson et al., 2009). Managing the rising social and economic costs associated with these incidents therefore is a key challenge for all governments.

Nowhere is this challenge more pronounced than in an industry such as construction.

At $US3 trillion, the construction sector is one of the world's largest industries, accounting for some 10% of the gross domestic product (GDP) and employing about 180 million, or 7% of the workforce (Murie, 2007). In the United Kingdom the Gross Value Add (GVA) of the industry was estimated to be £89.5 billion (representing 6.7% of total GVA) and a workforce in excess of 2.04 million or 6.4% of all paid workers (Maer, 2012). In Australia, the industry is the fourth largest contributor to Australia's GDP and plays a major role in economic and social growth (Australian Bureau of Statistics, 2010). The industry also provides direct employment to some 963 700 workers, the fourth largest employment sector after retail, health care and social services, and manufacturing (Australian Bureau of Statistics, 2011). Selected indicators of construction classified by size are shown in Table 1. The industry is dominated by small and medium-sized business which employs 86% of the construction workforce, contributes to over 76% of the income and over 90% of the operating profits in the industry. Construction is therefore important to the economic and social contributor to the fabric of Australian society.

Table 1

Selected Indicators of the Australian Building Industry (2008-2009)

Selected Indicators	Small	Medium	Large	Total
Employment (000)	743	150	136	1 030
Wages and salaries ($m)	17 330	10 283	12 501	40 114
Total income ($m)	138 520	62 717	64 853	266 090
Total operating expenses ($m)	117 926	57 029	62 347	237 296
Operating profit ($m)	19 215	5 921	2480	27 616
Industry value add (4m)	44 080	20 315	18 916	83 210

(Source: Australian Bureau of Statistics, 2010)

However, construction is also one of the most dangerous industries because of its relatively poor health and safety performance. For example, over 100 000 workers are killed annually on construction sites, with the fatality rates being five times greater than the average workforce (Murie, 2007). 751 work-related construction fatalities were recorded in the United States (US) in 2010, making it one of the most dangerous industries (Bureau of Labor Statistics, 2011). In the United Kingdom one-third of all work-related fatalities occur in construction; workers are six times more likely to be killed compared to employees in other sectors (Health and Safety Executive, 2003), with the most recent statistics suggesting 50 deaths and 2.3 million working days lost due to work-related injuries and diseases (Health and Safety Executive, 2012). In Australia at least one construction worker continues to die every fortnight (Fisher, 2008), with the industry experiencing a fatality rate of 4.5 fatalities per 100 000 employees, which is significantly more than that experienced by manufacturing (2.5), wholesale trade (2.0) and electricity, gas, water and waste services (2.2) (Australian Safety and Compensation Council, 2010). Table 2 illustrates trends in fatalities of selected industries for the period 2004-2009.

Table 2

Fatalities in Selected Australian Industries (2004-2009)

Industry	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Agriculture. Forestry and Fisheries	66	58	48	64	73
Transport, Postal and Warehousing	51	58	77	77	66
Construction	27	43	50	40	44
Manufacturing	22	24	32	25	25
Mining	8	14	10	8	12
All Australia	252	288	300	293	286

(Source: ASCC 2010)

The statistics suggest that, except for transport, postal and warehousing, number of fatalities plateaued off in the last two years; with construction (and mining) showing an increase, while in other traditional industries such as manufacturing the numbers stayed steady.

Apart from fatalities, incidence rates are another common indicator of health and safety performance, and Figure 1 illustrates trends from 1999 to 2009. The graph suggests some improvements in the first seven years, followed by a plateauing off in the last three years. These improvements are welcome sign; however, the fact that the incidence rate remains very high at 21.8 per 1000 employees in 2008-2009 makes it one of the most dangerous occupations (Australian Safety and Compensation Council, 2010).

Figure 1: Incidence Rates of Australian Construction Industry (1999-2009)

These are telling signs that existing strategies, whilst being useful, are failing to meet their mark in driving health and safety improvements further than what has been achieved, and more innovative solutions are needed.

1.2 THE COMPLEXITIES OF CONSTRUCTION

There are a number of things that occur in construction that set it apart from other traditional industries such as agriculture or manufacturing. Construction work can be dispersed physically over several, sometimes distant, locations, with each construction site deemed to be a new workplace, effectively creating a series of 'mobile factories' which are disassembled and relocated once the project is completed (Bakri, Zin, Misnan, & Mohammed, 2006). However, the conditions at the new site might be completely different from earlier sites. Construction working environments are also dynamic, with frequent rotations of work teams, changing weather conditions, and a high proportion of unskilled, temporary and transient workers (Rozenfeld, Sacks, Rosenfeld, & Baum, 2010). In addition, construction work is risky because of outdoor operations, work at heights and use of sophisticated plant and machinery (Choudhry & Fang, 2008); on some of the more larger construction projects tendering processes associated with subcontracting may give little attention to safety, leading to cost and corner cutting (Dingsdag, Biggs, Sheahan, & Cipolla, 2006). On-site subcontracting also increases the risks of injuries (Azari-Rad, Philips, & Thompson-Dawson, 2003); with the nature of the work, poor attitudes and behaviours, ignorance, pressure from budget cuts and time restraints compounding the risks (Choudhry & Fang, 2008). Moreover, some of the 'unique work practices within the construction industry make it vulnerable to poor OHS outcomes' (Vimonsatit & Nikraz, 2011, p. 536). The industry is also highly fragmented, and the temporary nature of works that are involved means that lessons from previous works are not adequate to predict new sources of hazards (Al-Humaidi & Tan, 2009). In essence, this means that the construction industry is a complex one (Bertelsen & Koskela, 2005; Doloi & Lim, 2007).

One consequence of this complexity is that improving health and safety in construction work can be more difficult than in an industry such as manufacturing (Rozenfeld et al., 2010). Buildings and structures under construction continue to collapse even today, and achieving higher levels of safety performance appears to remain elusive; 'it is difficult to concede that with all the technological advances that have been made in the industry, the number of accidents that occur in construction remains higher…'(Benford Jr, 2008, p. 1). These necessitate the need for more innovative approaches.

For its part, the Australian government has responded to these challenges by initiating a series of structural reforms in health and safety.

1.3 STRUCTURAL REFORMS

In Australia governments at both federal and state levels and territories have, over the last two decades, implemented a range of initiatives aimed at reducing workplace fatalities, injuries and diseases. Among these included establishments such as the Australian Building and Construction Commission (ABCC), the Federal Safety Commissioner (FSC) and Safe Work Australia (SWA).

The ABCC was an independent statutory body established as a result of a Royal Commission of Inquiry into the building and construction industry, commonly known as the Cole Report (Cole, 2003). The inquiry found that the building and construction industry was characterised by a widespread disregard for the law, with existing regulatory agencies having insufficient powers and resources for enforcing the law. The government's response to this was an interim Building Industry Taskforce (BIT) established in 2002; by 2004 it had become a permanent taskforce until the establishment of the ABCC in 2005. Until its abolishment in 2011 the ABCC had the primary responsibility of ensuring that 'building work is carried out fairly, efficiently and productively for the benefit of all building industry participants and for the benefit of the Australian economy as a whole' (Department of Employment and Workplace Relations, 2010, p. 2). While BIT focused on the enforcement of industrial relations, the Act also enabled the establishment of the Office of the FSC (OFSC) for (i) promoting sustainable occupational health and safety cultural change in the building and construction industry, (ii) developing and administering the Australian Government Building and Construction OHS Accreditation Scheme, and (iii) identifying and progressing initiatives aimed at improving OHS performance (Office of Federal Safety Commissioner, 2010).

The activities of the above two agencies are directed at organisations that are involved in building and construction works for the Federal Government. This is different to the third agency, SWA, which was established in 2009. This is a tripartite body composed of state governments, unions and industry representatives, and charged with the responsibility of 'improving health and safety and workers' compensation arrangements across Australia' (Safe Work Australia, 2010a). SWA is jointly funded by the Federal, State and Territory governments through an intergovernmental agreement (IGA) signed in July 2008.

As a legal entity SWA is a relatively new body. However, the range of functions it carries out was conducted by its predecessors, including the National Occupational Health and Safety Commission (NOHSC, 1980-2005), and the Australian Safety and Compensation Council (ASCC, 2005-2008). Under the latter a 10 year National OHS Strategy 2002-2012 was put in place, and adopted by its predecessors. This strategy had a vision of achieving 'Australian workplaces free from death, injury and disease' (National Occupational Health and Safety Commission (NOHSC), 2002, p. iv). National OHS targets, principles, and priorities were also established. Priority two; 'Develop the capacity of business operators and workers to manage OHS more effectively' (National Occupational Health and Safety Commission (NOHSC), 2002, p. 5), is particularly relevant to this research. This priority involves building capacity within individual workplaces to control health and safety risks. The first aspect of this strategy involves the development of legislation, while the second concerns the management of health and safety risks.

1.4 LEGISLATIVE CONTROLS

In Australia, the legislative controls for health and safety reside with the six states two territories because the Commonwealth does not have the general power to legislate over this issue (National Research Centre for OHS Regulation, 2012). This meant that, until the 1970's, a large number of highly 'prescriptive' legislation existed, most of which were based on 19th century British traditional health and safety legislation (National Research Centre for OHS Regulation, 2012). The first major reforms, based on the recommendations made by Robens (1972) saw the move towards performance–based legislation. These were aimed at preventing work-related injuries, diseases and deaths, compensating workers who sustained injuries or diseases, and rehabilitating workers (Johnstone, 2004) by fostering safe and healthy working environments and safe systems of work (National Occupational Health and Safety Commission (NOHSC), 2002). Another series of reforms were initiated over the next two decades, creating a mix of prescriptive, general duties, performance-based and process-based regulations (Bluff & Gunningham, 2004; Gunningham, 2007).

However, despite these reforms the legislation was still inconsistently applied across the states and territories. For example, by 2000 there were at least ten separate Acts, nine of which applied to the building and construction sector, in addition to some '30 statutes that relate to some aspects of the industry's operations; and at least 20 principal regulations, and another 34 other regulations, most of which have some application to the industry,' (Cole, 2003, p. 15). In essence, this created a system of law that was deemed to be fragmented, disjointed and uncoordinated, inequitable, wasteful and inefficient (Cole, 2003; Productivity Commission, 2004a, 2004b). Further reforms were initiated; most recently this included harmonisation of health and safety laws, a process that began with the ideas of 'national uniformity' in the early 1990s (National Research Centre for OHS Regulation, 2012). Model Work Health and Safety Bill and Regulations were developed and issued for consultation by SWA with an expectation that this will become a common set of laws for health and safety across all states and territories in Australia. This harmonisation was also expected to create, for the first time, a common set of health and safety standards for the building and construction industry, and enable more effective management of health and safety at workplace level. At the time of writing this thesis, the harmonised laws have been adopted by most states and territories except Victoria. The current state government has argued Victorian workplaces were already the safest compared to other states and territories; and adopting the harmonised laws would add to the regulatory burden of compliance to small and medium-sized businesses (Baillieu & Rich-Phillips, 2012; WorkSafe Victoria, 2012).

It is no doubt that legislation is a key driver for improving health and safety. However, having a legislation in place by itself does not mean accidents and injuries can be prevented; they need to be supported with strategies and tools that organisations can use to manage health and safety risks that arise from the conduct of work.

1.5 ORGANISATIONAL STRATEGIES

A range of strategies for preventing accidents and managing health and safety risks have been developed as a result of lessons learned through (i) organisational accidents that have occurred in the past and (ii) health and safety research from a wide range of academics disciplines such as engineering, sociology, management and psychology. Borys (2007), citing the works of authors such as Bohle and Quinlan (1999), Hopkins (1995), Hale and Hovden (1998) and Reason (1997), suggest these strategies can be categorised by activity, responsibility, time period or by a model. One model associated with the time period, termed the ages of safety, is of relevance to this particular research. According this model safety management strategies have evolved over at least five different ages of safety. The first was characterised as technical age or wave, the second as human factors age or the systems wave, the third as management systems age or the cultural wave, the fourth as integration age, and the fifth as adaptive age (Borys, Else, & Leggett, 2009), illustrated in Figure 2.

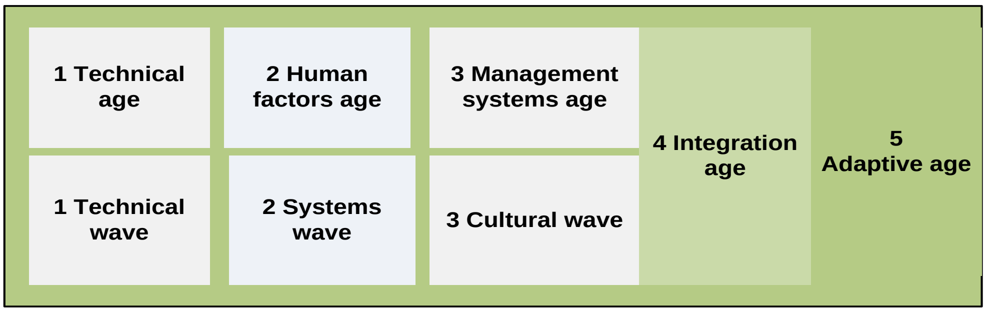

Figure 2: Five Ages of Safety

(Adapted from Borys, et al., 2009)

The fifth age, the authors argue, did not replace the other ages but transcended them (Borys et al., 2009). The age of adaptation has been associated with RE, a recent innovation in health and safety management, which is the main premise of this thesis.

In a more recent paper Hopkins (2011) has suggested that there are two broad approaches for managing health and safety; risk management and rules compliance. This classification is also important because this research involves the examination of one set of rules; SWMS.

1.6 SAFE WORK METHOD STATEMENTS

In Australia SWMS are required under the National Standard for Construction Work for at least 19 (19) activities (National Occupational Health and Safety Commission (NOHSC), 2005a), listed in Table 3. These requirements have been adopted by all states and territories; hence represent the backbone of construction safety in Australia (Pillay, Borys, & Else, 2011).

However, despite being regulated, the usefulness (or otherwise) of SWMS safety has not been demonstrated to date, mainly due to the lack of empirical research on SWMS (Borys, 2012). Anecdotally, SWMS are seen to be too 'cumbersome' in terms of paperwork, overly onerous on the part of those trying to develop and/or use them, without any commensurate safety gains (D. Else, personal communication, 2010). An evaluation of the construction industry Memorandum of Understanding (MOU) on health and safety between the New South Wales Government and the construction industry highlighted that, while *formal documented systems* (emphasis added) for managing safety had generally improved to meet legislative and management system requirements, the 'documented safe work practices, however, often do not translate to *actual safe work practices* (emphasis added)' (WorkCover NSW, 2001, p. 5). Similarly, an evaluation by the Health and Safety Executive found that method statements were treated as paper with little benefits (Health and Safety Executive (HSE), 2003). It is therefore questionable whether SWMS are of any benefit in addressing health and safety risks in construction, or merely an attempt by regulators to create an illusion of safety through paperwork.

Table 3

Construction Activities for Which SWMS are required

(National Occupational Health and Safety Commission (NOHSC), 2005a)

a.	construction work where there is a risk of a person falling two metres or more;
b.	construction work on telecommunications towers;
c.	construction work involving demolition;
d.	construction work involving the disturbance or removal of asbestos;
e.	construction work involving structural alterations that require temporary support to prevent collapse;
f.	construction work involving a confined space;
g.	construction work involving excavation to a depth greater than 1.5 metres;
h.	the construction of tunnels;
i.	construction work involving the use of explosives;
j.	construction work on or near pressurised gas distribution mains and consumer piping;
k.	construction work on or near chemical, fuel or refrigerant lines;
l.	construction work on or near energised electrical installations and services;
m.	construction work in an area that may have a contaminated or flammable atmosphere;
n.	tilt-up and precast concrete construction work;
o.	construction work on or adjacent to roadways or railways used by road or rail traffic;
p.	work on construction sites where there is any movement of powered mobile plant;
q.	construction work in an area where there are artificial extremes of temperature;
r.	construction work in, over or adjacent to water or other liquids where there is a risk of drowning; and
s.	construction work involving diving.

1.6.1 COMMON MISCONCEPTIONS ABOUT SWMS

A key assumption behind the use of SWMS is that workers will follow procedures and rules. However, 'people do not always follow procedures' (Dekker, 2003, p. 233), and violations of procedures and rules are common in industry (Dorner, 1996; Reason, 1990, 2008). Moreover, sometimes these violations may be necessary for achieving safety (Alper & Karsh, 2009; Besnard & Greathead, 2003; Reason, Parker, & Lawton, 1998). As Schein contends, 'workers… learn that no matter how clearly the rules are specified…the world is (to some degree) unpredictable, and one has to be prepared to use one's innovative skills' (Schein, 1996, p. 13). This learning leads them to adapt; subsequently, such adaptations become part of the organisation's normal ways of working. Moreover, because procedures and rules 'always require an interpretation to bridge the gap between assumed and actual conditions, work as actually done is always different from work as imagined' (Huber, van Wijgerden, de Witt, Dekker, & Hollnagel, 2007, p. 11). Hence there will be always be gaps between work as imagined (assumed) and work as performed (actual).

What is important about this gap (between work as imagined by management and work as actually performed by workers) is that it is also an important marker of RE (Borys et al., 2009; Hollnagel & Woods, 2006; Nemeth, 2006; Wreathall, 2006), which is the most recent innovation in health and safety management. So SWMS offers us a way of exploring the gap between work as imagined and work as performed, and give us an understanding of whether SWMS enhance or impede RE as a health and safety management strategy.

1.7 PROBLEM STATEMENT AND IMPORTANCE

Work-related incidents and fatalities place a significant burden of economic and social costs on the Australian society. The construction industry is of a particular concern because not only is it a dangerous and hazardous industry, it is also complex, with SWMS regulated as a strategy for controlling risks of high-risk construction in Australia.

The main problem however, is that 'there is a lack of research around the role of SWMS in controlling risks' (Borys, 2012, p. 210). Hence, the philosophical knowledge underpinning the very essence of SWMS has not been established. What is known is that safety procedures and rules are adapted to suit the context, so 'empirical studies are necessary to model the nature of workers' and managers' adaptation on construction sites and the extent to which safe and effective adaptations really happen' (Saurin, Formoso, & Cambraia, 2008, p. 1182). SWMS provide an objective means through which such empirical studies can be conducted.

This study is important because the construction industry is not only an important contributor to the Australian economy but also one that is hazardous and dangerous. The plateauing of health and safety performance in the industry indicate that existing strategies for addressing health and safety risks, while driving some level of improvement, appears not to be working in reducing risks further than what has been achieved. The central premise behind this thesis is that RE offers a complementary approach that can be used to drive these improvements further.

This study is important because the construction industry is not only an important contributor to the Australian economy but also one that is hazardous and dangerous. The plateauing of health and safety performance in the industry indicate that existing strategies for addressing health and safety risks, whilst driving some level of improvement, appears not to be working in reducing risks further than what has been achieved. The central premise behind this thesis is that RE offers a complementary approach that can be used to drive these improvements further.

1.7.1 PURPOSE AND RESEARCH QUESTION

The purpose of this study, then, is exploratory – to develop an understanding of whether SWMS enhance or impede RE as a health and safety management strategy in construction organisations.

To achieve this purpose the key research question I sought to answer is '*do safe work method statements enhance or impede RE as a health and safety management strategy in the Victorian construction industry?*' I do not intend to develop a theory regarding RE or SWMS; nor to rigorously test any theory or hypothesis concerning the effectiveness or otherwise of RE or SWMS. It would be premature for me to do so given the lack of published empirical research on SWMS, and the absence of a suitable theoretical and conceptual framework for RE.

Consistent with the exploratory nature of research, this thesis uses case studies drawn from three construction organisations operating in Victoria, Australia.

1.8 UNDERLYING THEORIES

In seeking to develop an understanding of whether SWMS enhance or impede resilience engineering as a health and safety management strategy in construction organisations, this thesis builds on two main theories; systems and social construction of safety.

1.8.1 SYSTEMS THEORY

The systems theory of organisations was first floated by Chester Barnard, who had a growing interest in how humans in a social system coped with the growing technological complexity of industrial life (Gabor & Mahoney, 2010). A system is a set of interrelated and interdependent parts arranged in a manner that enable it to function as a whole to achieve a common purpose (Robbins, 2003; Samson & Daft, 2005). The parts comprise of technology (computers, systems and networks), processes, ways of doing things, and people; all the things deemed necessary for effective functioning of the system as a whole.

Early researchers classified organisations into two broad typologies, closed and open (Robbins, Bergman, Stagg, & Coulter, 2006)[1]. Closed organisations are mechanistic in a design, 'characterised by high specialisation, rigid departmentalisation, narrow spans of control, high formalisation, limited information network, and little participation in decision-making by lower-level employees' (Robbins et al., 2006, p. 305). In reality, however, 'all organisations are open systems (Samson & Daft, 2005, p. 65),' more organic, 'highly adaptive and flexible,' (Robbins et al., 2006, p. 305). Formalisation of procedures is not deemed necessary, and there is a greater reliance on innovation and creativity.

An organisation is not static but a dynamic entity that is continually adapting to achieve its objectives and respond to changes. In fact, there is a growing recognition that organisations are complex adaptive systems which are 'fluid and flexible' (Schneider & Somers, 2006, p. 351). As authors such as Burnard and Bhamra (2011) posit, 'an organisational system is composed of a complex network of interrelated elements and subsystems (composed of both social and technical components) that interact' (p. 5583). As such they cannot be

[1] There are other ways to describe the typology of organisations, including coupling and interactivity suggested by Perrow (1999), X and Z by Erik Hollnagel (2008a). However, I have chosen to use closed and open systems.

understood by studying parts in isolation. The very essence of the system lies in the interaction between the parts and the overall behaviour that emerges from these interactions (Ottino, 2003). It is these interactions that give rise to emergent behaviour that lead to operations being either safe or unsafe; hence understanding these interactions is important in understanding how safety in organisations is achieved.

In comparison to traditional industries such as agriculture and manufacturing, construction work environments have been suggested to be more organic (Choudhry & Fang, 2008), so ideas from systems theory can be applied to this industry.

There are a number of researchers who are advocated a systems approach for examining organisational safety, including Rasmussen (1997), Rasmussen and Svedung (2000) and Leveson (2002, 2011). Rasmussen (1997) has suggested a framework that seeks to decompose the dynamics of risk management in socio-technical systems. The methodology I have used in research and discussed in greater detail in Section 4.3 includes six elements that constitute the socio-technical construction system.

1.8.2 SOCIAL CONSTRUCTION OF SAFETY

In discussing the systems view of organisations, it was suggested that safety is an emergent property of a system, not something that can be inherently built into the system itself. This idea of safety being an emergent is closely linked with safety being a social construct, a process of discovery (Wildavsky, 1988). Similar ideas were floated in the mid-1990s by authors such as Simpson (1996). Citing Zerubavel (1991), she posits that people's perceptions of safety and danger were inter-subjective, the 'products of social construction, collective agreement, and socialisation' (Simpson, 1996, p. 550). The notion of safety being a social construct has also been suggested in high-reliability theory. Gene Rochlin, in his seminal work; 'Safe operation as a social construct' (Rochlin, 1999) was one of the first to argue this case. Quoting Slovic (1992), he posits that 'safety does not exist out there independent of our minds and culture, ready to be measured, but is a constructed human concept' (Rochlin, 1999, p. 1550).

Organisational learning theorists such as Gherardi and Nicolini (2002a) are also active proponents of this school of thought, arguing that safety was an organisational competence that arose from a constellation of interconnected practices, socially constructed, innovated and transmitted to new members (Gherardi & Nicolini, 2002a). In more recent years Cook, O'Connor, Render, and Woods (2004) have extended this thinking by suggesting that safety was an emergent ability (instead of a fixed state) of a system because people continuously created safety. As the authors argue:

'(Failure-free) operations are the result of activities of people who work to keep the system within boundaries of tolerable performance. These activities are, for the most part, part of normal operations and superficially straightforward. But because the system operations are never trouble-free, human practitioner adaptations to changing conditions actually create safety from moment to moment.' (Cook et al., 2004, p. 24)

This notion of safety being a social construct and associated with adaptation has also been embraced by proponents of RE such as Woods and Cook, who have argued that 'safety is created here at the sharp end as practitioners interact with the hazardous processes inherent in the field of activity in the face of multiple demands and using the available tools and resources' (Woods & Cook, 2002, p. 138). This research collects and analyses data on how people at different levels perceive the creation of safety in construction settings.

1.9 OUTLINE OF THESIS

Chapter 1 provides the context for this research and sets the scene for an investigating whether SWMS enhance or impede RE as a construction health and safety management strategy. Chapter 2 includes a review the literature that informs this study, by revisiting the state-of-the art on construction health and safety and safety rules and violations, followed by an examination of RE, concentrating on its development as a school of thought, and a synthesis of previous research published in this area. Particular attention is paid to the theoretical and conceptual approaches that have been considered in the published research. Gaps in the literature are summarised, and a conceptual framework derived from the literature is used to develop and refine the research question that informs this thesis.

Chapter 3 discusses the theoretical and research frameworks behind my research. The three common paradigms of research in the social sciences are introduced first, followed by an exploration of the epistemology of positivism. The theoretical framework of symbolic interactionism is discussed next as an appropriate theoretical framework for informing this study. The essence of interviews, documents, and observations are also explored, highlighting their strengths and weaknesses as data collection methods. This chapter concludes with some personal reflections.

Chapter 4 discusses the research design employed. The socio-technical system that constitutes construction work is introduced, followed by a discussion of how this can be used for multi-level case analysis as a method for examining the SWMS phenomena. The specific methods of data collection used for collecting, analysing and for maintaining the 'quality' of data are also discussed here. Again, this chapter concludes with some reflections.

The results of this study are presented in Chapters 5 and 6. A chapter has been devoted each to the combined views of government/regulator and industry association, which I have called organisational outsiders, and of the 'insiders' of the three organisations. Results of the latter are further broken down at three levels (managers, workers, and supervisors). Data collected through interviews, documents and observations are presented separately for each study site, followed by a thematic analysis of the data. Thick descriptions and triangulations have been used, and the findings compared and contrasted to develop the evidence base and provide support for the thesis.

Chapter 7 outlines the limitations of my study and briefly discusses the utility of the theoretical frames I used to inform my thesis. This is followed by a discussion of the findings by linking them with the research questions; in doing so find some answers for the research questions refined in Chapter 2. I conclude by highlighting implications of my findings, contributions my thesis seeks to make and unanswered questions which provide opportunities for further research in Chapter 8.

CHAPTER 2: LITERATURE REVIEW

2.0 INTRODUCTION

It has been suggested that the 'gap between work as imagined and work as performed' is important in RE (Hollnagel & Woods, 2006, p. 357) However, at present, RE itself has a number of fundamental problems. For example, there is no uniformly accepted definition of resilience (Braes & Brooks, 2010, 2011) or of RE (Gao, 2010; Sheridan, 2008). The language used in the published literature refers to a multitude of factors, indicators, measures of both resilience and of RE, hence it is a 'semantically overloaded term in the sense that it means somewhat different things in different fields' (Madni & Jackson, 2009, p. 186). This means that developing a nuanced understanding of what it is, or what it is not, especially in relation to previous research makes it difficult. Hence, the purpose of this literature review is to locate the 'gap between work as imagined and work as performed' within the broader RE literature. Before I do this, I believe it is equally important to consider two other related academic areas of interest that inform this thesis. One involves health and safety in construction and the second is about the safety rules. For this reason, I will review these first.

I first discuss the methodology employed for identifying and selecting the papers presented in this review.

2.1 METHODOLOGY USED

2.1.1 LITERATURE SEARCH

The identification and search for relevant literature involved a systematic examination of three main databases (Academic Search Premier, CINAHL and PsycINFO) through the EBSCOHost platform. The keywords initially used for the three main areas of research included reviews in construction health and safety*, reviews in construction safety management* (for construction health and safety), reviews in safety rules/violations* (health and safety rules), RE,* organisational resilience* and work as imagined versus work as performed* (RE). I examined the articles generated from the initial searches closely to identify titles that appeared to be most relevant to the three ideas identified above.

Once useful articles were identified, the books, conference proceedings and journals in which they were published were noted and used to conduct specific searches for articles. In addition, I used the reference lists from the articles to search and obtain more articles through the electronic databases identified above and Google Scholar using the authors' names as keywords. Full-text articles that were available online were printed; copies of articles not readily available were obtained through the online document supply services of University of Ballarat (UB).

2.1.2 INCLUSIONS, EXCLUSIONS, AND SELECTION CRITERIA

In order to be included, the studies were required to be peer reviewed, written in English and include one or more of the following: (i) definitions of the terms, (ii) measures, dimensions or concepts and (iii) theoretical underpinnings, and (iv) published between 2007 and 2012 (construction health and safety and safety and rules) and between 2002 and 2012 (RE). I made a deliberate choice to limit the publications to five years for the first two areas of research because at the time I had started thinking about doing research in construction, a number of reviews on construction safety management had been already been published, including those on safety culture in construction by Choudhry, Fang, and Mohamed (2007a) and the effectiveness of interventions previously used for improving construction safety (van der Molen et al., 2007). Similar reviews had also been published on safety rules and/or violations (Amalberti, Vincent, Auroy, & Maurice, 2006; Besnard & Greathead, 2003; Bruns, 2009; Mascini, 2005), and I did not want to revisit these. However, one exception I made was to include Hale and Swuste's (1998) seminal work on safety rules.

Figure 3 summarises the literature search and review strategy used. A total of 74 papers were included in the final review.

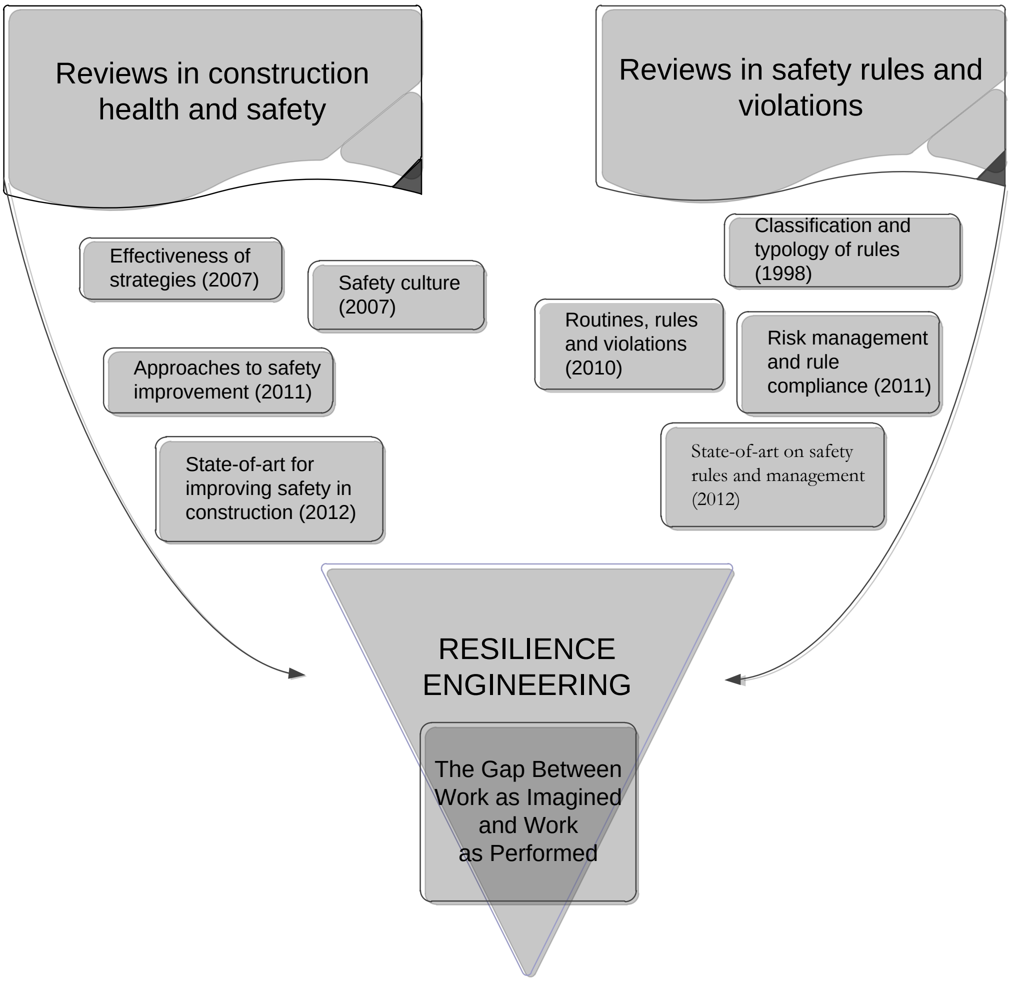

Figure 3: Literature Search and Review Strategy

2.2 CONSTRUCTION HEALTH AND SAFETY

Despite being recognised as one of the most hazardous and dangerous industries, construction has received relatively little focus in terms of health and safety research (Ringen, van Duivenbooden, & Melius, 2010). Recent years have seen some steps taken to redress this anomaly, with special issues published by the American Journal of Industrial Health (June 2010), Journal of Safety Research (2008, 2010) and Construction Management and Economics (2012). Interdisciplinary journals such as Safety Science, Project Management, Construction Engineering and Management have also started publishing topical articles on construction health and safety, and the topic is frequently discussed in a range of conferences on construction and safety. The published research has looked at a wide range of issues, for example; causes of accidents in the industry (Behm & Schneller, 2012; Hale, Walker, Walters, & Bolt, 2012; Jackson et al., 2011); behaviours (Bohm & Harris, 2010; Chekah, Yegani, & Yakchali, 2011; Choudhry & Fang, 2008; Lombardi, Verma, Brennan, & Perry, 2009; Zin & Ismail, 2012), culture (Benford Jr, 2008; Biggs, Davey, & Freeman, 2011; Ismail, Hashim, Ismail, & Majid, 2009; Wadick, 2008, 2010), management systems and practices (Abudayyeh, Fredericks, Butt, & Shaar, 2006; Cameron, Gillan, & Duff, 2007; Cheng, Ryan, & Kelly, 2012; Ellis, 2012; Flynn & Sampson, 2012; Jensen & Friche, 2010; Rivara & Thompson, 2008).

Seen from the five ages of safety introduced in Chapter 1 (Figure 2), most of these papers are from the second and third ages; the broad strategies include a combination of human factors/systems and management systems/cultural approaches. However, while it has been claimed that the different approaches show some degree of positive influence on performance, many have not been adequately synthesised in a coherent manner to highlight current knowledge and best practices through a more integrated approach (Lin, 2010). Some steps have been taken to address this anomaly, with a number of notable reviews being published on the subject in recent years; for example, on the effectiveness of interventions for prevention of injuries, (van der Molen et al., 2007), safety culture (Choudhry, Fang, & Mohamed, 2007b) and current approaches and state-of-the art (Bhattacharjee, Ghosh, & Young-Corbett, 2011; Swuste, Fritjers, & Guldenmund, 2012). However, construction health and safety still remains an under-researched area.

van der Molen et al. (2007) argued that while a number of different strategies for controlling health and safety risks existed, it was uncertain whether they had the ability necessary to reduce injury rates in the industry. A review they conducted identified 7,522 studies on health and safety in construction, but only five met the inclusion criteria, even when they had expanded the criteria. They concluded that there was moderate evidence of regulations and limited evidence of safety campaigns and drug-free programs in preventing fatal and non-fatal injuries (van der Molen et al., 2007). Based on their review the authors posit that the suites of technical, human factors and organisational interventions recommended by standard safety texts, consultants and courses have not been adequately evaluated; the quality of methods used for conducting research was generally poor, and that there were difficulties in conducting health and safety research in construction settings. This review was limited to randomised controlled trials (RCTs); cluster randomised controlled trials (cRCTs); controlled before-and-after studies (CBAs) and interrupted time series studies (ITSs), and based on reactive safety measures. The authors argued that cultural issues were also important for achieving safety.

Choudhry et al. (2007b) reviewed the literature on safety culture in order to clarify the definitions, models, levels of aggregation, construction safety culture and performance. The authors argued that existing definitions had considered people's perceptions but failed to take into account the environment, management systems and people's behaviour, which were equally important factors. Moreover, they argued for the need to consider the presence of subcultures created by different work groups; that safety climate was an expression of culture, and that safety culture provided a proactive measure of safety. This review was significant in extending the ideas of safety culture derived from highly hazardous industries (such as nuclear power plants [NPPs]) and transferring its applications to construction. Academics, practitioners, researchers and even regulators have embraced the notion of safety culture as a proactive approach to improving safety performance.

However, despite its widespread use, safety culture was (still) widely misunderstood and misused. For example, Haukelid (2008) argued that anthropologists disagreed with management consultants, organisational theorists and psychologists about what it meant. Hopkins (2002, 2005, 2006) has shown that it is something that is located in operators mindsets, while Silbey (2009) argued that the current approach to improving an organisation's culture was predominantly based on improving workers' behaviour and actions, with little attention being paid to the social relations, hierarchy and role of designers. Hence, organisational practices for improving safety culture are mostly aimed at behavioural and human factors. So while safety culture as a safety strategy is, in theory, associated with the third age/wave of safety, the rhetorical reality is that organisational practices appear to be embedded in the earlier, second age strategy, with limited attention paid to the organisational, management, social and technological factors. Le Coze and Dupre make this very point when they argue that 'it was not understood as a feature of the organisation, as an emergent property resulting from the safety practices and multiple trade-offs regarding production and safety between managers and operators, that cannot be attributed only to individuals, at the sharp end' (2008, p. 19).

Bhattacharjee et al. (2011) reviewed the effectiveness of approaches used to improve occupational safety in construction industry. This review found nine key approaches, including: (i) personnel selection, (ii) technological intervention, (iii) behaviour modification, (iv) poster campaigns, (v) quality circles, (vi) exercise and stress management, (vii) near-miss accident reporting, (viii) safety climate and (ix) zero-injury techniques were generally used; however, the burden of responsibility for these were always transferred on to the contractors. The authors argued that while the role of contractors was unquestionable, the ideal time to consider construction safety was during the design phase (Bhattacharjee et al., 2011). This review revealed that existing approaches for improving safety in the industry comprises of a range of approaches suggested by the ages of safety, with the zero-injury approach providing some level of integration as suggested by Borys et al. (2009). However, the authors' solutions for improving safety by design appears to be a step backward to the third age, which entails the consideration of ergonomics and human factors (Pillay et al., 2010) as part of the design stage. While safe design is a good aspiration, and something that any designer would like to achieve, the reality is that it can be difficult to achieve. As Woods and Hollnagel (2006), citing Rasmussen (1983) suggest, there will always be holes in the design process, because even the best of designers have a limited capacity and capability to identify and prevent unforeseen hazards (Leveson, 2002, 2004). Hence it becomes the operators' responsibilities to fill in these holes, amid a 'variety of difficulties, complexities, dilemmas and trade-offs' while being required to achieve 'multiple, often conflicting, goals' (Woods & Cook, 2002, pp. 138-139).

Swuste et al. (2012) reviewed the state of art to examine whether or not it was possible to influence safety in the building sector. In their review they used the bowtie method[2] to represent the accident process and the organisation triangle (comprised of culture, structure and processes) to relate behaviour to organisational forces. This review identified that safety management systems either did not work or were limited, business processes were fragmented and it was not clear who held the responsibility for safety (Swuste et al. 2012). Furthermore, safety detracted from the primary production process, was seen as a bureaucratic burden, and those working at the lower end of the construction hierarchy usually bore the burden of responsibility. This latter finding supports the findings of the earlier review in that the responsibility for achieving safety primarily lie with workers, i.e., those working with the 'sharp end' of the risk (Cook et al., 2004), including subcontractors (Bhattacharjee et al., 2011).

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[2] The bowtie method is a risk evaluation method used for analysing and demonstrating causal relationships between hazards and controls, by summarising all plausible accident scenarios that are likely to exist around a hazard, identifying control measures, and how these control measures could fail

While these reviews constitute the state-of-the art, what appears to be missing is empirical evidence associated with the safety rules in the industry. This is in spite of the fact that regulators appear to be placing a high degree of emphasis on safety rules in a range of industries, including construction[3]. In the next section, I analyse the published reviews of safety rules and violations.

2.3 SAFETY RULES and VIOLATIONS

Safety rules are an integral part of any strategy for managing health and safety (Hale, Heijer, & Koornneef, 2003; Hopkins, 2011) and an important means of communicating expectations in organisations (Hayes, 2009). A slow stream of empirical research papers has been published on this area over the last ten years. These papers have looked at a range of issues, such as the negative and positives sides of violations (Besnard & Greathead, 2003), models of procedures and safety (Dekker, 2003), and violations in a range of working contexts such as aviation (Hobbs & Williamson, 2002), healthcare (Amalberti et al., 2006; Dickson & Flynn, 2012), mining (Laurence, 2005) railways (Hale et al., 2003) and construction (Baiche, Walliman, & Ogden, 2006). A number of reviews have also been published on the subject (Alper & Karsh, 2009; Desai, 2010; Hale & Borys, 2012a, 2012b; Hopkins, 2011).

According to Hale and Swuste, 'a safety rule is a defined state of a system, or a defined way of behaving in response to a predicted situation, established before the event and imposed upon and/or accepted by those operating in the system as a way of improving safety or achieving a required level of safety' (Hale & Swuste, 1998, p. 164). This definition suggests safety rules established fixed ways of responding and limited freedom of choice. In this sense safety rules act as a form of organisational control and can be used while doing different things, such as (i) setting goals, (ii) establishing a process or (iii) outlining a course of action (Hale & Swuste, 1998). The authors do not advocate one type of rules over others, arguing that each has their advantages and limitations. Making the different types of rules explicit and focusing on the translation process between them will provide guidance to those having to make the choices and also define the rules for those who they were designed for (Hale &

[3] The Building and Design Regulations in the UK and Safe Work Method Statements in Australia are typical examples

Swuste, 1998). This typology of rules is useful; however, it has not been applied to contemporary settings such as construction. Hence, as a set of rules, it is unknown whether these typologies, such as SWMS, are expected to set goals, establish a process or enable an action.

Alper and Karsh (2009) reviewed the causes of safety rule violations in a range of organisational settings, including healthcare, commercial driving, aviation, mining, railroads and construction. Their review, based on 13 studies, revealed that a number of different factors worked in unison to create conditions for individuals making the decision to violate or not. Moreover, the decision to violate had both benefits and costs. Some of the perceived benefits included reduced time pressure or increased productivity, and costs included accepting greater levels of risk (Alper & Karsh, 2009). In essence this is about making trade-offs between efficiency and thoroughness (Hollnagel, 2009a), which are conflicting goals and generally difficult to achieve in normal operations. Using Reason (1998), who suggested violations were sometimes necessary and therefore the right action, the authors posit that it was necessary to understand the reasons why workers violated safety rules in order to design their work environments to eliminate or reduce the need for such violations, or to facilitate violations where they were necessary. In this review only one article from construction was included; this suggested omissions caused by failure in site organisation, procedures not being checked properly, lack of training about regulations which led to ignorance, conflicts and/or confusions between different trades, pressures to complete work, changes to approved designs and complicated, labour-intensive details from multiple trades were among the main reasons for violations by workers (Alper & Karsh, 2009; Baiche et al., 2006).

Desai (2010) reviewed the relationship between routines, rules and violations in organisations. The author defined violation as the 'voluntary and intentional departure of behaviour from rules governing how that behaviour should occur within organisations' (Desai, 2010; p. 185). Based on this review, the author suggested that when violations of rules occurred, it was more likely due to the fact that the current ways of working were inadequate, creating an opportunity to search for newer ways of organising and working. Moreover, organisations learned from particular types of experiences; new knowledge was shared across distributed operations and integrated into new structures and activities and this often led to improvements in performance (Desai, 2010). He further argued that violations of rules represented a sign that an organisation was drifting away from a state of fitness, and understanding how new routines were formed provided a clue about learning and adaptation in organisations.

Desai's review highlights two different points. The first is that violations are necessary if the rules are not suited to the current context of work. In other words, they made a positive contribution to safety by encouraging imagination and innovation (Wildavsky, 1988). The second is that violation of rules moved an organisation away from a state of safety to another state. This represented a negative side. Another important finding here is that organisations develop routines which assist them to mediate between the different states; it is possible that routines help an organisation continue operating in a state of safety.

Hopkins (2011) proposed that compliance with rules represents the traditional while risk management represents the new or modern approach to health and safety management. Using examples such as the BP Texas Oil and the Buncefield explosions, he argued that risk assessments were not useful for decision-makers working down the line, so (some) technical rules were necessary to assist them in the decision-making process. Further, he posits that technical rules established within a risk management framework were appropriate in instances where (i) an agreed good industry practice was already in place, (ii) regulators were seeking to push higher standards, (iii) the consequences of failure were potentially catastrophic, and the public unwilling to accept any risk analysis that suggested the risks were acceptable (Hopkins, 2011). He however, does not suggest a return to prescriptive-based legislation, but posits that converting risk management requirements into rule compliance could be a better way of achieving regulatory objectives in some cases. Hopkins review was limited to technical rules as they related to the oil and gas industry; one that is highly technical in nature and employs operators who are highly skilled and experienced. In contrast, contemporary industries such as construction do not necessary have the level of technology that exists in the oil and gas sector. The construction industry also employs a mix of unskilled, semi-skilled and highly skilled workers, so the way rules in this industry are used are expected to be different in comparison to the oil and gas industry.

In a recent review, Hale and Borys (2012a) examined the management of safety rules and procedures. Their review suggested there were generally two different prototypes of rules, which they labelled as Models 1 and 2. The first involved a traditional, top-down approach where rules and procedures were treated as a static set of behaviours imposed on operators at the sharp end of risk to limit freedom of choice, while the second a bottom-up constructivist approach which treated them as a dynamic, local and situated constructions of workers, adapted to suit the reality of work (Hale & Borys 2012a). The authors posit that each of these approaches had their strengths and limitations, further arguing that monitoring and adaptation of rules were central to their management, and that the participation of those the rules were designed for was important, both in the rule-making process and in maintaining them. In a later paper, these authors proposed a framework for managing rules by drawing on the lessons from the two prototypes (Hale & Borys, 2012b). The framework suggested by Hale and Borys (2012a, 2012b) is yet to be empirically tested. In a context such as construction, it is unknown whether SWMS form part of the Model 1 or Model 2 paradigm.

A key finding of Hale and Borys (2012a, 2012b) and Desai (2012) is that safety rules were adapted to suit the actual context and reality of work demands. Adaptation is a central facet of RE, the most recent innovation in health and safety management and the central focus of this research study. In the following section I review RE as a field or research and practice.

2.4 RESILIENCE ENGINEERING

RE was introduced as an approach to improving organisational safety in high-risk and complex industrial domains such as healthcare, petrochemical, aviation and NPPs, following the Columbia space shuttle disaster (Woods, 2003, 2005, 2006b; Woods & Wreathall, 2003). On February 1, 2003, Columbia disintegrated upon re-entry to earth, killing all seven crew members. The first report into the accident, released by the Columbia Accident Investigation Board (CAIB) in August 2003, identified three main factors that preceded the disaster. These included: (i) physical failures that led directly to Columbia's destruction; (ii) underlying weaknesses in the National Aeronautics and Space Administration's organisation and history that paved the way to catastrophic failure; and (iii) other significant observations that were believed to be unrelated to the accident (Columbia Accident Investigation Board (CAIB), 2003).

These factors, however, were not unique to Columbia. As Woods (2005) posits, there were five common observations that could be made from insights of, previous organisational accidents similar to Columbia. These included: (i) a drift towards failure as defences thinned to achieve production pressures; (ii) treating previous successes as a sign of confidence in the system and therefore not anticipating and planning for potential future failures; (iii) problem-solving approaches that were fragmented and narrowly focused; (iv) risk assessments not being revised in spite of new evidence emerging; and (v) breakdowns at the boundaries of organisational units that subsequently affected communication and coordination, causing organisations to become brittle and therefore more susceptible to disasters (Woods, 2005). RE was developed based on insights arising from these five patterns of organisational behaviour (Woods, 2005; Woods & Wreathall, 2003).

Following the publication of the CAIB report, four international symposiums have been held on the subject. The first of these was at Söderköping, Sweden in 2004, and led to the publication of *Resilience Engineering Concepts and Precepts* (Hollnagel, Woods, & Leveson, 2006), which can be regarded as the seminal work in this field, marking 'the maturation of a new approach to safety management' (Hollnagel et al., 2006, p. 3). Further symposiums were held in France (2006, 2008 and 2011), as well as a workshop in Sweden (2007), with a special issue on the subject published by the Institute of Electrical and Electronics Engineers (IEEE) in 2009. The editorial acknowledged that RE was a new concept associated with the management of unexpected surprises that pushed systems beyond their safe operational boundaries (Attoh-Okine, 2009). A review of the literature suggests that RE is slowly gaining momentum. However, it is still relatively young as a field of study, research and practice (Sheridan, 2008; Woltjer, Johansson, & Lundberr, 2007).

The series of papers I reviewed for this thesis suggests that RE research has been published from a range of domains. Prominent among these include aviation (Chialastri, 2011; Chialastri & Pozzi, 2008; Dijkstra, 2006; Gomes, Woods, de Carvalho, Huber, & Borges, 2009; Malakis & Kontogiannis, 2011; Tjørhom & Aase, 2011); healthcare (Anders, Woods, Wears, Perry, & Patterson, 2006; Brattheim, Faxvaag, & Seim, 2011; Miller & Xiao, 2007; Nemeth, O'Connor, & Cook, 2009; Nemeth, Wears, Patel, Rosen, & Cook, 2011; Nemeth, Wears, Woods, Hollnagel, & Cook, 2008; Perry, Wears, & Anderson, 2006; Sujan, Pozzi, Valbonesi, & Ingram, 2011; Wears, Perry, & McFauls, 2006; Williams, 2009); the nuclear industry (Costa et al., 2008; de Carvalho, Costa, & Mol, 2011; de Carvalho, dos Santos, Gomes, & Borges, 2008; de Carvalho, dos Santos, Gomes, Borges, & Huber, 2006; Hildebrandt, Broberg, Massaiu, Dhillon, & Tarasewicz, 2008; C. W. Johnson, Herd, & Wolff, 2010); petrochemical (Dinh, Pasman, Gao, & Mannan, 2012; Hansson, Herrera, Kongsvik, & Solberg, 2009; Herrera & Hovden, 2008; Øien, Massiiu, Tinmannsvik, & Størseth, 2010; Shirali, Mohammadfam, Motamedzade, Ebrahimipour, & Moghimbeigi, 2011; Shirali, Motamedzade, Mohammadfam, Ebrahimipour, & Moghimbeigi, 2012; Skjerve, Kaarstad, Størseth, Waero, & Grotan, 2012; Størseth, Albretschsen, & Eitrheim, 2010; Størseth, Tinmannsvik, & Øien, 2010; Vugrin, Warren, & Ehlen, 2011). A small number of articles have also been published from other domains, such as electricity distribution (Saurin & Júnior, 2011a); manufacturing (Costella, Saurin, & Guimarães, 2009; Heikkila, Ulusitalo, Lappalainen, & Rantanen, 2010); and railways (Hale & Heijer, 2006).

While RE itself is new, the ideas and concepts that it builds on have been part of the organisational risk management literature for over two decades. The notion of resilience appears to have been first discussed by Wildavsky (1988), who can be credited for extending the ideas of ecological resilience espoused by Hollings (1973) into the health and safety domain. It has also been associated with high-reliability organisations (Hopkins, 2009a; Weick & Sutcliffe, 2001, 2007; Weick, Sutcliffe, & Obstfeld, 1999) and cognitive systems engineering (Hollnagel & Woods, 1983; Rasmussen, Petersen, & Goodstein, 1994; Woods, 1998). According to Woods (2006b) it 'builds on advances in modelling and measuring complex adaptive systems, high-reliability organisations, and results of how people adapt to make systems work despite complexity' (p. 2), and 'continues to evolve as a vibrant theme among researchers who deal with system safety, policy and organisational studies' (Nemeth, 2009, p. 12). For this reason it is a useful tool for construction that has been suggested to be both complex and dynamic. Moreover, SWMS are part of the regulatory regime in Australia, so RE is associated with policy, at least at the level of government. Hence RE provides a useful lens through which SWMS can be investigated.

Before this can be done, it is useful to examine how RE has been defined in the published literature; this is covered in the next section.

2.4.1 DEFINITIONS

Being a relatively new term, at least in the context of safety, one could assume that there is a common understanding of resilience, or of RE. However, this is not the case. For example, the *Collins English Dictionary* defines resilience in a person as 'recovering easily and quickly from misfortunes or illness' but in an object as 'capable of regaining its shape or position after bending or stretching' (*Collins English Dictionary*, 2003). A close examination of the literature suggests there are major variations in the way different researchers have interpreted resilience; to some extent I agree with the suggestion made by Dekker (2006) who describes

RE as 'confused consensus'; in spite of the increased number of peer-reviewed studies being published on organisational resilience and RE, there is no single way in which these terms have been defined. The definitions appear to vary between the contexts in which they are applied.

In the next section, I summarise a number of definitions of resilience as it relates to organisations, for a review of RE can be deemed incomplete unless one understands *organisational resilience* first.

2.4.1.1 Organisational Resilience

There are many definitions of *organisational resilience*; examples of 17 such definitions are shown in Table 4. Sheridan (2008) probably captures the concept best as 'a family of ideas (p.423).

A common theme within these definitions is that it is an ability, capability or capacity. While there is some diversity, this ability appears to be associated with being able to recover size and structure (Epstein, 2008), withstanding major disruptions (Haimes, 2009), absorbing disturbances and change (Malakis & Kontogiannis, 2011), maintaining function and structure (Weick & Sutcliffe, 2007), bouncing back Wildavsky (1988), handling disruptions and variations (Woods, 2006a) and recovery to a stable state (Wreathall, 2006). However, this notion of resilience appears a little constricted and tied to reactive models of organisational safety. Moreover, it softens the importance of resilience considering its influence in achieving 'nearly accident-free performance' in spite of the fact that the domains it has been investigated in have generally involved highly hazardous technologies (Hopkins, 2009a; La Porte, 1996; Leveson et al., 2009). The focus on safety in these 'high-reliability industries' was not simply about bouncing back from adverse events as they happened or recovering from harm once they were encountered; instead, it extended to guarding against potential minor mishaps and performance variations of normal operations escalating into major breakdowns of organisational processes.

For Flin (2006) and Hale and Heijer (2006), this ability enables the organisation's ability *to anticipate and circumvent threats to its primary existence*, while Hollnagel (2006) suggest this recovery occurs very early in the process. These views associate resilience with (i) achieving stability to single events, (ii) the existence of a single stable state (Haigh & Amaratunga, 2010; Kendra & Wachtendorf, 2003) and (iii) a reactive outcome.

Table 4

Definitions of Organisational Resilience

(Adapted from Pillay, Borys, Else, and Tuck (2010))

Author(s) and Context	Propositions and Definitions
Wildavsky (1988) Theoretical	"the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back" (p.77)
Flin (2006) Case Study Nuclear	"the characteristic of managing the organisation's activities to anticipate and circumvent threats to its existence and primary goals" (p.223)
Hale and Heijer (2006) Theoretical	"the characteristic of managing the organisation's activities to anticipate and circumvent threats to its existence and primary goals" (p.35).
Hollnagel (2006) Theoretical	"the ability of a system or an organisation to recover from disturbances at an early stage, with minimal effect on dynamic stability" (p.16)
McDonald (2006) Theoretical	"the capacity (of an organisational system) to anticipate and manage risk effectively, through adaptation of its actions, systems and processes, so as to ensure its core functions are carried out in a stable and effective relationship with the environment" (p.157).
Westrum (2006) Theoretical	"the ability to prevent something bad from happening, or the ability to prevent something bad from becoming worse, or the ability to recover from something bad once it has happened" (p.59).
Woods (2006a) Theoretical	"how well can a system handle disruptions and variations that fall outside the base mechanisms/model for being as defined by that system" (p.21)
Woods (2006b) Theoretical	"the art of managing the unexpected, or how a team or organization becomes prepared to cope with surprises" (p.1).
Wreathall (2006) Theoretical	"the ability of an organisation (system) to keep, or recover quickly to, a stable state, allowing it to continue operations during and after a major mishap or in the presence of continuous significant stressers" (p. 275)
Vogus and Sutcliffe (2007) Theoretical	"the maintenance of positive adjustment under challenging conditions such that the organization emerges from those conditions strengthened and more resourceful" (p.3418)

Weick and Sutcliffe (2007) Theoretical	"capability of a system to maintain its function and structure in the face of internal and external changes and to degrade gracefully when it must" (p.69).
Bracco, Gianatti, Pisano, and Savona (2008) Theoretical	"emergent property of a complex system and comes from the joint interaction of a structure, its functions and an environment where they can take place" (p.3).
Epstein (2008) Theoretical	"the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress… for general usage it can be defined as the ability to recover from or adjust easily to misfortune or change" (p.55)
Grote (2008) Theoretical	"…the ability of the organization to handle unanticipated uncertainties that arise from changes in the environment and/or because the textbook envelop is incomplete, limited or wrong" (p. 92)
Seville (2008) Theoretical	"the ability of an organization to thrive, in both good and bad times in the face of adversity" (p. 2)
Haimes (2009) Theoretical	"the ability of a system to withstand a major disruption within an acceptable degradation parameters and to recover within an acceptable time and composite costs and risks" (p. 498)
Hollnagel (2009b) Theoretical	"(a resilient system) is able effectively to adjust it functioning prior to, during, or following changes and disturbances, so that it can continue to perform as required after a disruption or a major mishap, and in the presence of continuous stresses." (p. 117)
Malakis and Kontogiannis (2011) Case Study Air Traffic Control	**"**the ability of a system to adapt or absorb disturbances, disruptions and changes, especially those that fall outside the textbook operation envelop" (p. 103)

However, it also has a proactive side (Boring, 2009); in that resilient organisations see safety both as a non-event (i.e., success) such as near-misses, and events such as failures, incidents or disasters (Hollnagel, 2011a; Resilience Engineering Organisation, 2011). Westrum's definition of resilience, *the ability to prevent something bad from happening, prevent bad from becoming worse, or to recover from something bad once it has happened*, is suggestive that recovery is one of three important outcomes of resilient organisations. The other two are about prevention of adverse events, and managing the degree of damage, harm or outcomes from the adverse event. For Hollnagel (2006), this is most likely due to the fact that recovery occurs at an early stage; 'it is easier to recover from a potentially destabilising event if it is detected early' (p. 16). This view seeks to suggest that there is more than one single event or stable state, with resilience mediating between a number of different stable states (Haigh & Amaratunga, 2010; Kendra & Wachtendorf, 2003).

The above are all useful definitions, and the outcomes they seek to achieve are desirable, in fact required, if organisations are to survive in the current times of turbulence and uncertainty. However, they do have limitations, because all organisations should be able to able to bounce back from adversity. In fact, one could argue that most organisations, at least in these times, should be able to perform under pressure, absorbing the stress, pressures and strains imposed on them. Current organisational theory suggests that organisations are complex adaptive systems (Dalziell & McManus, 2004; Schneider & Somers, 2006), which could then mean that all organisations would be deemed resilient, at least to some degree.

However, two things appear to set resilient organisations apart from non-resilient ones. The first is their ability to continue performing well without being affected significantly; the fact they 'operate smoothly even in difficult situations' (Hale & Heijer, 2006), 'recover quickly to a stable state' (Wreathall, 2006), 'adjust easily' (Epstein, 2006), become 'strengthened and more resourceful' (Vogus & Sutcliffe, 2007) and even 'thrive during adversity' (Seville, 2008) serve to illustrate this point. While most organisations absorb stress and react by shutting down completely or running their operations at reduced capacity (hence sustain significant losses in terms of performance), resilient organisations absorb such stresses and strains and continue to operate normally. They are able to do this because they are working under stress as part of their normal operations (Hollnagel, 2009b; Wreathall, 2006). Hale and Heijer (2006) suggest this of their ability to effectively manage and use resources to achieve conflicting goals simultaneously, while Weick and Sutcliffe (2001, 2007) suggest this is because they have learned from previous errors and corrected deficiencies before they worsened and caused more serious harm. Under this premise, resilience is an ongoing process of continuous positive adaptation, with the changes enabling future positive adaptive changes. This premise assumes the interactions are bidirectional, and the recognition that previous adaptations determine (positive) adaptive outcomes hence fits naturally into a systems perspective.

The second is their ability to deal effectively with more than normal, everyday threats and disturbances. This is consistent with the thinking of authors such as Widavsky (1988), for whom it was about the ability to deal with *unanticipated dangers*; or of Woods (2006b), for whom it is about *coping with surprises*. Hence it involves going beyond past experiences and being prepared for unknown events, threats and/or hazards, being able to deal with 'black swans' (Gibson & Tarrant, 2010) or 'unexampled hazards' (Epstein, 2008; Westrum, 2006). For Malakis and Kontogiannis (2011) and Woods (2006a), it is about effectively dealing with disturbances, disruptions and changes *beyond the textbook envelope*. Similarly, Hamel and Valikangas (2003) argue that resilience was not about responding to a one-off crisis or rebounding from a setback; rather, it was more about continuously anticipating and responding to weak signals, 'having the capacity to change before the case for change becomes desperately obvious' (Hamel & Valikangas, 2003, p. 3). Instead of relying on successful experience of strategies, approaches and interventions previously deployed as an indication that things are fine and therefore will work in future these organisations continue to devote efforts to anticipating and preparing to deal better with future hazards and threats.

The resilience ability is based on a firm conviction that 'unexpected trouble is ubiquitous and unpredictable; and thus accurate advance information on how to get it is in short supply' (Wildavsky, 1988, p. 120). Seen another way, there will always be 'holes' in design processes and this creates an opportunity for imagination, innovation, and creativity, all 'opportunities to bounce forward' (Resilience Expert Advisory Group, 2011, p. 13).

According to Weick and Sutcliffe (2001, 2007), resilience is associated with organisational norms and practices that encourage conceptual slack. Citing Roberts (1994), the authors suggest this was due 'to a divergence in organisational members' analytical perspectives about the organisation's technology or production process, a willingness to question what is happening rather than feign understanding, and a greater usage of respectful interaction rather to accelerate and enrich the exchange of information' (Weick & Sutcliffe, 2007, p. 73). The authors suggest three key abilities played a role with respect to resilience in these organisations. One was the ability to 'absorb strain and preserve functioning in the face of internal and external adversity, the second to 'recover from untoward events by stretching its capability (instead of collapsing)', and the third to 'learn and grow from previous episodes of resilient action' (Weick & Sutcliffe, 2007). The first two are related to the flexibility in operations to manage risks, while the third involves learning from success.

The analysis above seeks to suggest that the abilities of resilience exist across an organisation. However, as will be discussed later, these abilities can also exist at individual, team, and operational levels, and collectively these contribute to the system's resilience.

The definitions suggested by Westrum (2006) and Hollnagel (2009b) associate resilience with a set of three outcomes: prevention, fast response and rapid recovery. This also suggests that resilience occurs over the three phases of disruptions: pre-disruption, survival and recovery (Pellissier, 2011). In the pre-disruption phase the system takes steps to anticipate and avoid the disruption altogether if possible; in the survival phase it absorbs the disruption so that it can recover in the recovery phase; in this latter phase it resumes some degree of its original goals (Pellissier, 2011). What this also suggests is that resilience can be visible at any of a number of stages; first, before a disturbance occurs, i.e., during normal operations. As Hale and Heijer (2006) posit, this ability is shown when people in the organisation are able to make sacrifices in favour of safety when resources to achieve production targets are stretched. Second, during a disturbed state, as expressed by how the system reacts or is affected. For example, this could be during an event such as a fire, including a stimulated fire drill or physical activation of the fire protection system. Third, after the event; this can be seen in how easily and how soon the system returns to normal operations, or how well it is able to operate with a reduced capacity. The disturbances can include regular, irregular and unexampled threats (Epstein, 2008; Westrum, 2006). The difference with resilient organisations are their ability to deal well with the last two types of disturbance, as opposed to non-resilient organisations, which are more brittle and only capable of dealing with regular threats.

The response repertoire also suggests three possible types of adjustments: reactive, concurrent and proactive. Reactive adjustments, which are most common following an event, are usually incomplete because they may not be adequate or suitable for irregular and unexampled events that may occur at some point in time in future. Concurrent adjustments are rapid adjustments that take place while an event is unfolding, while proactive adjustments mean the system changes from a state of normal operations to maintain a heightened level of readiness for action before something happens. Implicit in this is an understanding that resilience is a latent property of a system. However, as authors such as Bracco et al. (2008) and Woods and Hollnagel (2006) suggest, it 'emerges from the complex interaction between a wide range of organisational attributes' (Resilience Expert Advisory Group, 2011, p. 13).

The definition suggested by McDonald (2006) suggests the ability to adapt is inherent in the *actions, systems, and processes*. According to this proposition, the essential abilities of adaptation should somehow be evident in any of these elements of a system. Actions usually manifest as *behaviours* which can be explored at individual, team and at organisational levels. Systems and processes are associated with the *organisational structure, management* and *technology*, all of which play a role in the ability to respond effectively when required (Dalziell & McManus, 2004).

The discussion above suggests that organisational resilience covers a wide range of concepts, ranging from abstract to concrete facets, and coming from a wide range of domains and applications, including high-reliability organisations (Weick & Sutcliffe, 2001, 2007), systems (Hollnagel 2006, 2209b; Wreathall, 2006; McDonald, 2006) and human factors (Woods, 2006), each of which 'reflects a different type of solution in terms of being proactive or adaptive, not only to prevent negative outcomes but also to support and strengthen outcomes of processes' (van der Vorm et al., 2011, p. 263). The analysis of definitions also suggests a great deal of uncertainty surrounding the notion. Manyena (2006) makes this point more clearly when she argued it was 'currently too vague a concept' and the key 'challenge facing researchers is to achieve a consensus on the definition' (p. 445). However, whether such a consensus is necessary is questionable, a view that is proposed by Woods, Schenk, and Allen (2009). I am tempted to agree with these authors; I believe that resilience itself is context-specific. Some organisations may be resilient in some aspects compared to others; and some sections of an organisation may display a greater propensity for resilience than others. For this reason, I will not attempt to provide a definition of organisational resilience, but continue with my analysis of RE. This is considered in the next section.

2.4.1.2 RE

Similar to organisational resilience, there is no single definition of RE. This is because 'it exists more as a conceptual framework than a tight knit knot' (Boring, 2009, p. 1590). The literature suggests four related, but somewhat different, definitions (Table 5).

The first definition by Woods and Hollnagel (2006) refers to RE as a 'paradigm which is an overarching conceptual construct, a particular way in which scientists make sense of the world or segment of the world' (Crotty, 1998, p. 35). This suggests it is a conceptual framework for safety management similar to the ten axioms of industrial safety suggested by Heinrich (Goetsch, 2005); human error (Petersen, 2003; Reason, 2000a, 2008); systems (Leveson, 2004; Leveson et al., 2009), normal accidents (Perrow, 1999) or high reliability (Hopkins, 2009b; Weick & Sutcliffe, 2001, 2007; Weick et al., 1999). The reference to complexity suggests RE is more useful in complex domains such as NPPs, aviation and healthcare (Baxter, 2010; Begun, Zimmerman, & Dooley, 2003; Plsek & Greenlagh, 2001; Plsek & Wilson, 2001). However, as I have argued in Chapter 1, the construction industry is also a complex one to work in, an view in line with other researchers (Baccarini, 1996; Bertelsen, 2004; Bertelsen & Koskela, 2005; Lebcir & Choudrie, 2011; Pennanen & Koskela, 2005). Hence, it can be relevant to this industry as well.

Table 5

Definitions of Resilience Engineering

Adapted from Pillay et al. (2010)

Author(s) and Context	Propositions and Definitions
Woods and Hollnagel (2006) Theoretical	"a *paradigm* [emphasis added] of safety management that focusses on how to help people cope with complexity under pressure to achieve success" (p.6)
Chialastri and Pozzi (2008) Research Aviation	"resilience engineering refers to the broader definition of adaptation, whether the system can handle variations that fall outside the design envelop" (p. 87).
Pillay et al. (2010) Theoretical Mining	"resilience engineering involves the developing an organisation's behavioural and cognitive capability such that it is able to effectively adjust and continue performing optimally near its safe operating envelop in the presence of everyday threats and environmental stressors at all levels of the organisation" (p.134).
Resilience Engineering Organisation (2011) Heikkila et al. (2010) Mixed industrial (construction and metals)	"resilience engineering represents a new way of thinking about safety."

The second definition suggests it involves adaptation. For Hollnagel (2009b), this is about temporary adjustments by responding, monitoring and anticipation, and learning from disturbances, changes, major mishaps or continuous stressors. Again, most organisations have these abilities to some degree, for all have to anticipate and respond to threats, monitor their performance and learn from incidents and failures, albeit to different degrees. However, RE requires (i) responding to regular, irregular, and (to some extent) 'unexampled' threats (Epstein, 2008; Westrum, 2006) in a robust, yet flexible, manner, and this can only happen when people know what to do, both in known and unknown situations (Weick & Sutcliffe, 2001, 2007; Wildavsky, 1988); (ii) monitoring what is going on, including its own performance; by focusing on the critical, i.e., knowing what to look for (Hollnagel, 2009b, 2011a); (iii) anticipating risks and opportunities in the longer term, which assists in knowing what to expect (Adamski & Westrum, 2003; Hollnagel, 2009b; Westrum, 1992); and (iv) learning from experience. Because an individual is not expected to possess all these four abilities, these are characteristics of organisations that are comprised collectively of groups, systems and processes (Robbins, 2003; Robbins et al., 2006; Schneider & Somers, 2006).

Under the above definition, RE appears to be some form of a process; included within this processes are a number of sub-processes that collectively assist the organisation to deal effectively with variations (or stressors and pressures placed on it). Some of these sub-process are captured in the definition suggested by Pillay et al. (2010), including behaviours and cognition. Behaviours are well known and well researched in health and safety, they largely comprise the actions taken by people at different levels of the system. Following rules/procedures or violating them can be observed through behaviours. Cognition, however, is more within the domain of organisational and/or occupational psychology and something a 'generalist' health and safety practitioner is not necessarily familiar with, so I believe a brief look at this is warranted here.

According to McGinnis (2007), cognition 'refers to the mental process involved in thinking, including attending to information, processing information, and ordering information to create meaning that is the basis for acting, learning and other [human] activities' (p. 41). I believe this is closely associated with the notion of sense-making (Maitlis & Sonenshein, 2010; Weick, Sutcliffe, & Obsteld, 2005), a social construction process that occurs when discrepant signals interrupted an individual's ongoing activity (Maitlis & Sonenshein, 2010). Sense-making is thus 'an interplay of action and interpretation' (Weick et al., 2005, p. 409), but at an amplified level. Cognition triggers sense-making such that the normal tools of the trade are seen as cognitive artefacts (Jones & Nemeth, 2005; Norman, 1991). Norman (1991) suggests things such as checklists used by pilots can enhance memory by acting as a memory aid—a form of secondary checking—and assist in making a decision about what to do next. If a checklist did not exist, the pilot would then need to remember everything that needs to be done; having a checklist reduces the need for this. Hence, checklists are a form of instrument that improve and change cognitive capability. Two types of cognitive artefacts have been suggested. One includes *endogenous* types that are developed or constructed by the users themselves; another includes *exogenous* types that are developed outside and installed for use (Jones & Nemeth, 2005; Jones & van deer Chisalita, 2005). Checklists developed by the pilots themselves would then be regarded as the endogenous types, while those that appear on a computer screen would be deemed exogenous. Hence, in RE, cognition enables the system to operate close to the boundaries by responding to weak signals and implementing proactive actions so that the system, as a whole, stays within its safe operating envelope.

The definition by the Resilience Engineering Association (REA), and used by Heikkila et al. (2010), suggests that it is a new way of thinking about the management of safety, pointing out what is different in RE:

Whereas conventional risk management approaches are based on hindsight and emphasise error tabulation and calculation of failure probabilities, resilience engineering looks for ways to enhance the ability of organisations to create processes that are robust yet flexible, to monitor and revise risk model, and to use resources proactively in the face of disruptions or ongoing production and economic pressures (Heikkila et al., 2010, p. 2)

There appear to be three central tenets of this definition: the first is that it is different to conventional/traditional approaches to managing safety, which are based on tabulating and counting the frequency of errors and failures. Hollnagel expresses this more succinctly:

(resilience engineering) sees the 'things go right' as the flip side of the 'things that go wrong' and therefore assumes that they are the result of the same underlying process. In consequence of that, 'things that go right' and 'things that go wrong' should be explained in basically the same way. It therefore makes as much sense to try and understand why they go wrong. In fact, it makes more sense because there are more things that go right than things go wrong, the ratio depending on how (im)probable an accident is considered to be' (Hollnagel, 2011a, pp. xxxiii-xxxiv).

The important point made by Hollnagel (2011a) is the emphasis on success. This suggests that data collection and its analysis needs consider what worked, i.e., *successes* (including behaviours, procedures and routines) in order to obtain a deeper insight into how things actually happen when they go right (Hollnagel, 2009b, 2011a). However, this does not mean abandoning the data on failures (such as accidents, incidents, and/or existent hazards or risks). Hollnagel (2008) makes this point very clear when he argues that 'it is necessary to study both successes and failures and to find ways to reinforce the variability that lead to successes as well as dampen the variability that leads to adverse outcomes' (p. xii). This is because studying failures such as the one time in 10,000 that things went wrong meant missing the opportunity to learn from the other 9,999 times things actually went right (Hollnagel, 2009a, 2009b).

The second tenet is that RE is aimed at enhancing the abilities of organisations. From Hollnagel's (2009b, 2011) assertions, these enhancements are aimed at the abilities of responding, monitoring, anticipating and learning, while for Madni and Jackson (2009), anticipation, learning and adaptation abilities were central.

The third tenet is that RE is associated with the processes and systems for managing risks, such that they are both simultaneously robust and flexible, encourage monitoring and learning, and involve 'wise use' of scarce resources in a proactive manner amid everyday stressors and strains.

I believe that RE represents a sophisticated way for managing safety and risks in complex and uncertain working environments. The sophistication is not so much in the technology, but in the way we think about safety; about how it can be better managed through existing tools but in more innovative ways. Woods and Hollnagel made this very point when they suggested that it involved a 'completely new way of thinking about safety' (Woods & Hollnagel, 2006, p. 2); the main shift being the focus away from reactive to prospective views by foreseeing future events that were likely to challenge a system's performance, and the ability to manage unexpected challenges (Hollnagel et al., 2006). According to Borys and Else (2009), RE involves a shift in perspectives, or way of thinking, about safety management. In effect, it is 'a shift in goals and redefinition of what constitutes success' (Cook & Nemeth, 2006, p. 218). Some goals are abandoned to achieve others, so trade-offs across multiple goals are part of the norm (Branlat & Woods, 2010; Cook & Nemeth, 2006; Woods & Branlat, 2011a, 2011b). These 'trade-offs occur at relatively high levels within the goals-means hierarchy' (Cook & Nemeth, 2006, p. 218). Instead of making a minor trade-off, sudden threats present opportunities for a significant failure, creating conflicts that require workers at the sharp end to refer to high-level goals; in RE such threats are addressed by taking things in one's stride (Cook & Nemeth, 2006), in other words treating this as a normal way of doing their work.

The above analysis has unpacked the definitions surrounding RE. Similar to organisational resilience, there is no universally accepted definition of RE. I believe seeking a consensus on organisational resilience will not be useful; however, developing one for RE is necessary in order to set the boundary and provide a focus for research. However, before I do this, I believe it is useful to understand how RE has been theoretically conceptualised in previous research. I discuss this in the next section.

2.4.2 THEORETICAL PERSPECTIVES OF RE

The published literature suggests RE has been investigated using a number of different factors and measures. However, what appears to be lacking in most of these published studies is the use of an agreed conceptual framework that integrates the various factors and indicators for examining, observing or measuring RE. This point is made by Le Coze and Pettersen (2008), who explored whether RE was a realist or constructivist approach to safety. The authors used critical realism and radical constructionism as their two main philosophical frameworks and demonstrated how these two different perspectives can be used to answer different research questions, arguing that both frameworks were relevant for *applied research* [emphasis added] (Le Coze & Pettersen, 2008). This suggests that both the realist and constructivist approaches were useful theoretical frameworks. However, Mendonça (2008) suggested that the functionalist and interpretive perspectives were useful frameworks for analysing RE studies, and have I used these two perspectives to examine how they have been employed in the published research on RE.

2.4.2.1 RE from a Functionalist Perspective

A number of papers have been published from the functionalist perspective. Central to this perspective are two notions. The first is that RE can somehow be measured objectively. This is useful to researchers seeking to measure RE because it gives them the ability to explore RE through objective methods and instruments. This approach is also useful to organisations that rely heavily on measurements. The second is that RE can be developed to increase safety at the organisational level. For researchers, understanding how this development occurs is crucial to adding to the body of knowledge on RE, while giving organisations practical tools they can use to develop RE.

Reason (2001) integrated Mintzberg's (1989) three drivers of commitment, competence and cognisance (the 3Cs) with principles, policies, procedures and practices (the 4Ps) to develop a matrix that he suggested could be used to locate an organisation within a safety space encapsulated between the two dimensions of 'resistance' and 'vulnerability'. He suggested a 20-point checklist as a way of assessing institutional resilience (CAIR) quantitatively (Reason, 2001), with each score being rated on a three-point scale (0, 0.5, and 1). Reason, however, does not provide a definition of resilience, or more precisely 'institutional resilience'. Furthermore, he posits that good scores on the CAIR did not mean an absence of errors and/or mishaps. Carthey, de Leval, and Reason (2001) revised the CAIR for use in the healthcare industry, acknowledging that while it constituted a wish list, it was not a tried and tested approach, and the items in the list were neither definitive nor comprehensive of a lack of knowledge at that particular time (Carthey et al., 2001). Wood, Dannat, and Marshall (2006) customised the CAIR and used it to investigate factors most likely perceived to facilitate safety culture and institutional resilience in airlines operating in the Asia-Pacific region. This research revealed that among others factors, (i) maintenance of standards or 'rules' associated with minimum competency requirements for designated aircraft types, and (ii) informal networks were considered to be critical for maintaining safety performance in the industry, and the role of senior leadership team was important in achieving organisational resilience (Wood et al., 2006).

Akselsson, Ek, Koornneef, Stewart, and Ward (2009) reviewed factors deemed important for improving safety in the European aviation industry, labelling these as 'resilience safety culture'. The authors acknowledge the concepts they had developed were still in the development stages; however, early indications were that a number of areas required particular attention. This included: (i) a re-examination of management commitment to safety, especially in challenging times; (ii) exploring means of transmitting such commitment to all staff; (iii) critiquing the assumed uses of safety culture; (iv) exploring better ways of understanding safety culture and (v) plugging in any 'holes' in the safety culture (Akselsson et al., 2009).

Seville (2008) suggested four distinct qualities distinguished resilient organisations from non-resilient ones: (i) an ethos for a constant strive towards improved resilience; (ii) good situational awareness of the threats and opportunities most likely to affect the organisation through active monitoring of weak and strong signals; (iii) a strong commitment to identify and manage key vulnerabilities in a proactive manner and (iv) a culture that promoted adaptive capacity, agility and innovation within the organisation (Seville, 2008). This author suggested a set of 23 behavioural indicators could be used for assessing an organisation's resilience. Building on this work, Stephenson (2010) expanded these factors into a survey tool comprised of 14 demographic, 53 resilience measurement and 15 organisational performance questions, and used internet-based semi-structured interviews to benchmark a random selection of 68 New Zealand organisations.

Pillay et al. (2010) reviewed the links between safety culture and RE by integrating Schein's ideas of organisational culture, Flin's ideas of managerial resilience, the indicators of resilient organisations suggested by Wreathall and those derived from the chemical process industry (Huber et al., 2007) to develop a set of indicators they suggested could be useful for assessing and improving resilience in mining operations. In developing their indicators, these authors argued that the indicators traditionally used for studying safety culture could be adapted to examine RE.

Shirali et al. (2011) examined safety culture and management based on the argument that these represented the backbone of RE, by means of a survey. The RE indicators used in this study focused on (i) schedule delays, (ii) safety committee meetings, (iii) meeting effectiveness, (iv) safety education, (v) worker's involvement, (vi) competence and (vii) safety training (Shirali et al., 2011). RE factors were assessed through (i) the degree to which controls were centralised or decentralised, (ii) management of change, (iii) risk management and analysis, and (iv) management commitment to safety and resilience (Shirali et al., 2011). The research demonstrated that a relatively simple survey could be used to identify deficiencies related to RE; in this particular case these included poor safety training, poor management of change and poor attitudes, which encouraged looking for scapegoats for plant failures and decision-making that placed production ahead of safety.

Authors such as Hale, Guldenmund, and Goossens (2006) argued that responding effectively to weak signals such as a health and safety audit was a feature of resilient organisations, and the use of existing safety management tools such as ARAMIS[4] was one way of conducting such diagnoses. A number of authors have published on the use of management system audits for examining RE (Costella et al., 2009; Saurin, Costella, & Guimarães, 2008), including some based on empirical research (Saurin, Costella, et al., 2008; Saurin & Júnior, 2011a, 2011b).

Saurin, Costella, et al. (2008) integrated structural and operational performance approaches to safety auditing with RE perspectives incorporating the four main principles (flexibility, learning, awareness, and top management commitment) suggested by Hollnagel (2009b). The authors developed a seven-point criterion and further divided this into 28 items based on the OHSAS18001 and ILO-OSH2001 safety management system standards, which they piloted at a Brazilian manufacturing company. Saurin and Júnior (2011a) revised this framework for auditing a Brazilian electrical distributor.

In a laboratory-based investigation Back, Furniss, and Blandford (2007) used Schön's (1987) work on reflection-on-action (ROA) and reflection-in-action (RIA) and a model of repetitions-distinctions-descriptions (Nathanael & Marmaras, 2006) to conduct a series of experiments to assess resilience in individuals. The results showed that an opportunity to reflect on action was essential for an individual to reason about why failures occurred, and this enabled future strategies to be formulated (Back et al., 2007). The authors concluded that individuals in organisation were able to develop cognitive strategies through constant

[4] ARAMIS is a an audit tool for risk assessment and management developed to support the implementation of Seveso II, the European Directive on Control and Management of Major Hazard Facilities. Guldenmund, Hale, Goossens, Betten, and Duijm (2006) discuss the tool in more detail.

rehearsals (ROA) and creation of personalised cues (RIA) in order to support resilient behaviour (Back et al., 2007). In addition, the authors posited that research aimed at understanding human behaviour needed to take into account the context that helped or hindered the development of such behaviours.

In a French study, Boissières and Marsden (2006) conducted a detailed analysis of the social interactions between supervisors and maintenance operators of a telecommunications company to identify factors that contributed positively or negatively to organisational resilience. The research revealed a number of characteristics of the social network that influenced the efficiency of activities 'carried' by social interactions, including density, elasticity and the presence of strong links (Boissières & Marsden, 2006). The results of this research provided support for the claims that social interactions were necessary for the continued provision of telecommunication services in times of crises, and that social network theory was an important instrument for assessing an organisation's vulnerability to crises.

Johnsen and Veen (2011) investigated resilience in the infrastructure used for emergency communication in the Norwegian railway system. The authors used risk assessment and an action research approach to explore whether of the system's resilience had increased over a two-year period. The factors investigated in this study included redundancy, controlled degradation and ability to rebound/recover, flexibility, management of margins and common mental models. Data for this study were collected through a questionnaire developed previously for measuring and improving information security and safety culture (Johnsen et al., 2007). The study revealed that the action research strategy used by the authors supported common understandings and models of risk and mitigating actions across different stakeholders, and that the system's resilience had improved through training and increased redundancy in manning and technical competencies. The authors argued that resilience was a useful strategy for mitigating security issues by improving capability to cope with surprises, diversity and flexible responses.

Based on the premises that contemporary ways of examining risks were not suitable for RE, authors such as Steen and Aven (2011) present another category of perspectives where they have replaced probability with uncertainty in defining risk. These authors presented an extended risk assessment framework and a conceptual framework based on basic ideas of RE and applied this to assess the risks of cyber-attacks on a railway system. The authors do acknowledge, however, that the risk perspective does not ensure resilience per se, but that their framework supported risk management and RE better than isolated processes based on resilience analysis alone because it ensured a broader perspective and linked risk, vulnerability and resilience.

In the industrial domain, risk assessments are generally conducted as part of the design and inception stage of a project, and Steen and Aven's findings seek to suggest this can be used to increase resilience in processes, systems and infrastructures as part of the conception and design stages. Some research on this aspect has also been published; for example, by Cedergren (2011, 2012). This researcher investigated the extent to which resilience was considered in the design stage of new Swedish railway tunnels. The author used case studies and interviewed key stakeholders involved in the decision-making process regarding safety measures in six railway tunnel projects. The results revealed that power relations between the different stakeholders influenced the decision-making process; diverse roles and perspectives between the different actors caused double binds being experienced by all actors, which, coupled with the significant influence from local actors on decision-making, resulted in restricted consideration of the system's resilience at regional and national levels (Cedergren, 2011, 2012). An important contribution from this research was an understanding of how micro-level decisions affect macro-level characteristics of complex socio-technical systems.

While these studies continue to add to the body of knowledge of RE, they have their limitations. In part, these limitations are based on the assumptions that are inherent in the functionalist perspective. Functionalism, according to Ardalan (2010) assumes that society has a concrete existence, follows a certain order, and the existence of an objective and value-free social science that can produce true explanatory and predictive knowledge of reality. Under this assumption RE is expected to be a concrete, objective 'thing', so scientific theories can be used to assess them objectively through empirical evidence gained by using scientific methods through 'formal propositions, quantifiable measures of variable, hypothesis testing, and the drawing of inferences from a representative sample to a stated population' (Mendonça, 2008, p. 33). However, many of the indicators used in some these studies appear to be inconsistent with the basic tenets of RE, including the understanding that resilience can be measured and/or quantified through tabulations of errors, behavioural and/or other factors. Resilience itself has been suggested to be a dynamic and emergent capability (Hollnagel & Woods, 2006). Hence, it cannot be measured, at least not until after an impact in most cases, a point that is also held by authors such as Epstein (2008), who argued that predicting it was perhaps easier.

In addition, there are many different definitions of RE, so multiple factors can be used for measuring it; making a choice about which factors to include and which to discard can be problematic. There are also limitations with the methods used in these studies. Surveys, for example, collect data through a series of questions based on what the researcher believes the participants think or feel about an issue, and hence provide a relatively superficial description of RE. What is not clear are the dynamic work practices that occur in teams and groups that make up organisations, for these cannot be described in a survey question (Hopkins, 2006). It is clearly important to recognise these interactions, because it is from them that both safety and resilience have been suggested to emerge (Hollnagel & Woods, 2006).

In a similar manner, safety audits usually uncover conformance/non-conformance against a series of established standards or expectations. A common shortfall with audits is that they limit the inquiry to those elements identified in the audit tool (Huber, van Wijgerden, de Witt, & Dekker, 2008). This is one of the reasons why their effectiveness as a method of inquiry has been criticised by authors such as Hopkins. In his analysis of the Longford Esso gas explosions in 1998, he argued that auditing 'provided only good news', and failed to 'identify problems that later acted as precursors to the disaster' (Hopkins, 2000, p. 91). A more advanced approach to safety auditing, termed 'verification' has been developed (WorkSafe Victoria, 2003) for investigating the effectiveness of risk control measures as part of the safety case assessment regime for major hazard facility regulations; however, it has not been empirically tested outside of the safety case assessment process.

The quantitative results of surveys and audits are generally relied upon as measures of health and safety performance in many organisations. Those organisations achieving high results would generally be treated as better performers; hence, the scientific merits of the data produced from both surveys and audits have an important bearing on organisational decision-making. However, a systematic review on the content validity of audits suggests there has been little research in this area (Robson, Macdonald, Van Eerd, Gray, & Bigelow, 2010). Moreover, the inter-auditor reliability was also poorer than expected in integrated ISO 9001/14001 assessment instruments (Dyjack, Redinger, & Ridge, 2003). Similarly, published research on the validity and reliability of survey instruments for measuring organisational resilience is limited. There is therefore a clear need to develop, test and validate these instruments (Mendonça, 2008).

To overcome some of these issues, research has also been published from the interpretive perspective and a number of these studies are reviewed in the next section.

2.4.2.2 RE from an Interpretive Perspective

The key notions within the interpretive perspective of RE is that resilience is an emergent property of a socio-technical system. It is therefore a more intricate perspective, which is more problematic because more effort is required on the part of researchers to understand how it emerges and develops. For organisations the problems are of a more practical nature, in that there is no single solution for developing RE.

Benson (2005) examined the role organisational culture played in creating secure and resilient supply chains following the aftermath of the 9/11 disaster using Schein's (1991) three levels of organisational culture framework (artefacts, espoused values and basic underlying assumptions). He used observations and interviews in organisations known to be high performers in terms of supply chain security and resilience across a range of industries (Benson, 2005).

de Carvalho, dos Santos, and Vidal (2006) examined how NPP operators dealt with formal constructs such as procedures, rules and norms amid organisational constraints in order to understand whether: (i) following procedures always constituted best practice, (ii) some violations of NPP procedures improved safety and (iii) the skills the operators needed to optimise performance amid the constant changes experienced in the working environment and the dynamics of conflicting activities that occurred at the research site. This research revealed a number of competencies used by NPP operators to manage emerging risks from major incidents amid the constraints imposed in this domain. These included (i) developing 'situation awareness' while undertaking the desired action, and (ii) understanding the task at a sufficiently global level to understand the most important demands. This required operators to understand the intent of the work procedures, alternative ways of initiating start-ups and shut-downs and managing attention resources for undertaking these; in addition to (iii) building mental simulations of the future of the process, for their own procedures and those of the other operators' (mutual situation awareness); (iv) managing conflicts, gaps and time problems created by this procedure (ongoing task procedures), the plant's technical specifications, the task planning schedule and the demands from NPP colleagues, adjusting the different time constraints of the procedure, the other operators' procedures, and the process and (v) dealing with distractions, developing skills for collaborative efforts with the other operators and plant staff by accepting, postponing or rejecting the interruptions they brought to one's own activities, and conversely by discovering the right moment to interrupt the others' activities (de Carvalho, dos Santos, & Vidal, 2006). The researchers concluded that understanding the local patterns of interaction (or behaviour of NPP operators) was one way of developing more 'workable environments' where undesired interactive patterns could be changed.

Cook and Nemeth (2006) examined resilience in the healthcare industry using case studies of a 'soft emergency' at an anaesthesia department and another at a major hospital following a bus bombing. In the anaesthesia case, the researchers observed how a group worked together to meet sudden demands for competing resources, discovering opportunities and presenting this to the different parties for consideration, avoiding confrontation and making use of slack or redundant resources (Cook & Nemeth, 2006). In the second case, the researchers traced the series of actions and interactions that followed a bomb explosion from the site of incident, travelling to the hospital, at the hospital, the operating rooms and the emergency room and returning to normal operations. The authors suggest that success was achieved through a configuration of the workplace, incentives and surrounding social structures involved in the two different healthcare settings (Cook & Nemeth, 2006). The authors did not suggest the participant's attention, knowledge, assessment and decisions did not play a part in achieving success. As they pointed out:

> "…confronted with a sudden demand, we observed the practitioners respond **purposefully and appropriately** (*emphasis added*). It was clear from their actions and speech that they recognised the demand and its significance. Their reaction responded directly to the demand…These resilient performances depend heavily, but not exclusively…on the particular expert cognitive abilities…Through their experiences, intentions, and judgements as events evolve, practitioners invest cognitive effort to maintain successful performance in the face of unexpected challenges. Cognition creates what we observe as resilient performance…" (Cook & Nemeth, 2006, p. 216).

Using Rasmussen's (1983) Skills-Rule-Knowledge (SRK) model, the authors suggested that what distinguished resilient performance from non-resilient ones was the practitioners ability to negotiate through the 'goals-means' hierarchy in order to address the threats as they arose. For example, 'much of the paperwork that is completed during routine operations is deferred or abandoned entirely during a mass casualty response' (Cook & Nemeth, 2006, p. 214). However, some routine paperwork, particularly that deemed critical for achieving higher-level outcomes, was maintained, e.g., that dealing with matching blood types, as successful transfusion depended on accurate documentation. Lower-level goals (such as completing routine paperwork) were sacrificed to achieve higher-level goals (such as ensuring timely treatment of patients), the escalating impacts of threats and the responses taken were constantly monitored, resources for handling immediate needs were balanced against future emergencies, smaller losses and failures were deliberately accepted to preserve opportunities for more valuable gains and successes and ends of threats were anticipated and work organised for returning to normal operations (Cook & Nemeth, 2006).

The results of these two cases reveal how front-line operators, or those working at the 'sharp end of risk' (Cook et al., 2004) make trade-offs between high-order goals such as the mundane completion of paperwork to achieve more higher-order goals, such as providing patient care under emergency situations. Observing and analysing such types of incidents in construction, however, can be difficult, if not impractical. An emergency needs to occur, and the researchers have to be there to closely observe and analyse what happened.

Bracco et al. (2008) developed a SRK framework based on Rasmussen (1983) to explain how unexpected situations were handled as weak and analogous signals were received and processed. They used this framework to analyse a case involving myocardial infarction that had originally been misdiagnosed because the people making decisions at different points of the healthcare system had not fully developed according to the SRK model. In a later article the authors developed the SRK framework further to capture the seven indicators of resilient organisations proposed by Wreathall (2006), and used it to examine the development of resilience in an Italian hospital setting (Bracco, Bruno, & Sossai, 2011). The authors argued that the tools developed for this framework (i) involved the operators in processing the information flow; (ii) raised their level of responsibility and ability to intervene to modify their environment, (iii) enabled the development of a database of safety and well-being solutions to be available that could be used for organisational learning, and (iv) allowed for a clear monitoring of processes (Bracco et al., 2011). In essence, the project led to a set of tools that the authors suggested could be useful for monitoring sustainable safe productive processes using an integrated cognitive and cultural framework.

Johannsson and Lindgren (2008) provided a set of factors they suggest could be useful in assessing system resilience. Four of these properties are aimed at detecting resilience, while nine at adaptation. The aim of this, according to the authors, was to give those practitioners who had not followed the development of the RE movement a tool that complemented traditional methods; suggesting that the main advantage with their tool was that assessments could be performed within a reasonable period of time and without much theoretical knowledge (Johannsson & Lindgren, 2008). These factors however, have not been empirically tested.

Weeks and Benade (2009) reviewed the role of organisational culture in terms of how an organisation responded to unexpected emergent conditions, the likely impacts on its resilience and its ability to survive. The authors suggested culture emerged from interactions in organisations, and these interactions were most likely to engender a culture of resiliency in organisations. Such a culture raised awareness, led people to question the status quo and influenced learning and adaptation (Weeks & Benade, 2009). Social interaction, in the forms of conversations and evident in stories, rituals, artefacts and symbols, take place in complex and extensive networks to create an organisational mindset that enabled the detecting, questioning and acting on weak signals across the organisation (Weeks & Benade, 2009).

Størseth, Albretschsen, and Eitrheim (2010) investigated how elements of resilience contributed to early recovery from high-risk incidents. Based on a theoretical review of a range of variables (such as risk understanding, anticipation, attention, response, improvisation, adaptation, robustness, redundancy, resourcefulness and rapidity) these researchers operationalised resilience as three 'contributing success factors' (CSF), and used these to examine recovery from high-risk incidents in the offshore petroleum industry (Størseth et al., 2010). This study emphasised the need to allow 'inter-level resilience jumps' between organisational layers, levels and focal points, with each CSF interpreted as a premise, a function or a kind of ability. The authors argued the CSFs should not be seen as a set 'matrix' that dictated a fixed path of influence, but were to be treated as a cluster of factors, and acted as thematic focal points for analysis (Størseth et al., 2010). Building on this work, Grøtan (2011) suggested that these CSFs represented a cluster of adaptive inventories that could be also be relevant for explaining work in normal operations. According to these authors, resilience could manifest itself as 'episodes' of adaptations through 'packets of order', and that these episodic adaptations could be analysed through the response-execution-leverage (REL) model, which was a CSF cluster.

The notion of episodic adaptation is useful for work contexts that do not last very long. If the idea suggested by Rasmussen (1983) was that it was up to the operators to make up for the holes left by the design process, it may be that such episodic adaptations are common and an ongoing part of normal working life. This means observing and analysing resilience in organisations does not need the simulation of an incident or emergency; one has to closely observe any activity that could be unpacked using the REL model (Grøtan, 2011).

Macchi et al. (2011) developed the Dimensions of Integrated Safety Culture (DISC), a conceptual model that integrates the four abilities of resilient organisations espoused by Hollnagel (2009b, 2011a) across a set of ten organisational functions for assessing RE attributes. The researchers applied this in the healthcare and nuclear domains. Results from the nuclear case study showed that proactive safety development was supported by safety management and leadership; however, these functions mostly contributed to safety as value rather than improve understandings about safety or creating the necessary preconditions for safety (Macchi et al., 2011). Based on the concept mapping of ideas from an RE perspective, the authors concluded that this showed the nuclear organisation had problems in *anticipating* what could happen and in *monitoring* for critical situations (Macchi et al., 2011). Based on the mapping of ideas from a RE perspective, the authors concluded that the ability to *anticipate* and the *ability to respond* were problematic for the healthcare organisations (Macchi et al., 2011). The authors concluded that the DISC was a useful tool for engineering resilience in organisations.

A different set of categories is provided by Malakis and Kontogiannis (2011), who identified failure-sensitive strategies used by air traffic control operators to deal with stimulated emergencies and abnormal situations. The researchers developed a taskwork and teamwork strategy in emergencies in air traffic management (T^2EAM) model to capture resilient processes, and used this to rate participants' performances on a seven-point behavioural markers scale across five individual and four team strategies (Malakis & Kontogiannis, 2011). The patterns of resilience examined in this research suggested different strategies were used, including challenging decisions for managing uncertainty, anticipating threats, standard planning and emergency planning. Such patterns 'emerged in a fluid and flexible manner and shifted in response to the dynamic evolution of the scenario' (Malakis & Kontogiannis, 2011, p. 115). The authors concluded that their model was useful for providing an insight into the local adaptations of actors in the form of cognitive strategies to support resilience, and it could be used for diagnosing weaknesses in their training and providing practical advice in overcoming these weaknesses.

In a more recent study, Tveiten, Albrechtsen, Waero, and Wahl (2012) examined how resilience could be engineered in emergency management by making it part of continuous risk and hazard management. The authors focused on (i) proactive anticipation of risks early in the process, (ii) adaptation to new and future work practices to (a) distributed actors and (b) new technology. The authors used ethnography and collected data through observations and workshops at two emergency handling training sessions involving offshore and onshore operators at two oil and gas companies located in Norway. The results of this study revealed that monitoring, anticipation, response and learning were important for addressing resilient emergency management; these principles needed to be embedded in all phases of the emergency management and the industry needed to consider changes in structure, roles, use of technology and work processes.

The above section has reviewed the RE literature published from the two main perspectives of functionalism and interpretivism. What appears to be common among these perspectives is that RE is associated with a number of different factors, a point made by Woods et al. (2009), who argued that studying RE did not entail a single property; there were many aspects to how a system adapted. In the next section, I review these attributes by examining the dimensions and measures published.

2.4.3 DIMENSIONS AND MEASURES

An analysis of the literature suggests RE has a number of dimensions. Maryline and Marc (2006) have broadly described these dimensions as structural, symbolic and relational, while Lengnick-Hall and Beck (2005, 2009) suggest cultural, behavioural and cognition. For the purposes of this review, I will use the latter classification.

2.4.3.1 Cultural Dimensions

The first theoretical connection between resilience and culture was proposed by Reason (2001), who integrated Mintzberg's (1989) three drivers of commitment, competence and cognisance with principles, policies, procedures and practices, as a method of assessing institutional resilience quantitatively. This tool was further developed by Carthey et al. (2001) and Wood et al. (2006) to measure resilience in the healthcare and aviation contexts.

Flin (2006) posited that one way in which organisations became resilient was when managers themselves showed such capabilities through their level of commitment to safety, which guided their decision-making when balancing production and safety goals, implementing safety systems and spending on safety programs and initiatives. Such organisations 'produce a belief that when safety and production goals conflict, managers will ensure that safety will predominate' (Flin, 2006, p. 229). Furthermore, she argued that such a culture created a climate where (i) workers and managers were more able to speak up when they were concerned about safety, (ii) workers were assured that they would not be penalised when they challenged their superiors, stopped production or expressed their concerns about risks (Flin, 2006). According to this view, RE can be examined at this level as 'managerial resilience culture'.

Wreathall (2006) provided an initial set of indicators, or 'themes of highly resilient organisations', based on reviews of high performance safety and work production in the aviation industry (Wreathall & Merritt, 2003). These included: (i) top-level management commitment, (ii) just culture, (iii) learning culture, (iv) awareness, (v) preparedness, (vi) flexibility and (vii) opacity (Wreathall, 2006). The author suggested there was a 'need to tie this approach to the concepts of resilience' (Wreathall, 2006, p. 280). The first three of these can be associated with Flin's (2006) criteria of managerial resilience. Skogdalen (2010) suggested these dimensions could be mapped into an organisational, human and technical factors model, the Operations-Management-Technology (OMT) method, while Bracco et al. (2011) integrated these into a SRK framework for examining resilience in healthcare organisations.

Woods (2006b) argued that RE had the ability to redefine the culture of safety and of risk management, and that attributes such as proactivity and adaptability were increasingly being associated with organisational resilience. Focusing on resilience, according Woods (2006b), meant changing one's views on how incident data were analysed and organisational culture interpreted. In addition, three of the themes identified by Wreathall (learning, justice and flexibility) have been suggested to be part of an organisation's safety culture (Hopkins, 2006; Reason, 1998, 2000b), while a just culture is also part of managerial resilience (Flin, 2006). So for Wreathall, some of the attributes of safety culture were also among those of resilient organisations, and further work was needed to link the two.

The central tenet of these papers is that safety culture and resilience are inherently linked. In essence, they suggest that a culture of safety is necessary for the development of organisational resilience (Akselsson, et al., 2009; Carthey, et al., 2001; Pillay, et al., 2010; Woods, 2006); in other words, one cannot develop organisational resilience without having developed a culture of safety first. If this premise is to be accepted, it lends some support to Höpfl's assertion that safety culture is an interpretive device (Höpfl, 1994). In this case, it is one that could be used for interpreting RE, because a number of attributes that have been used for assessing or examining safety culture are also applicable for RE (Akselsson, et al., 2009; Flin, 2006; Pillay, et al., 2010; Weeks & Benade, 2009; Wreathall, 2006).

However, these papers are largely conceptual and have not been empirically tested. *It could be therefore suggested that the link between safety culture and RE is still an area in need of further attention, both in terms of research and practice.* Komatsubra alluded to this very point when he argued for the 'need to consider further, therefore, the relation between the culture, which resilience expects, and resilience' (Komatsubra, 2006, p. 90). *More empirical studies are therefore necessary to develop and validate the links between safety culture and RE.*

It needs to be acknowledged, though, that there are those who are sceptical of this view. Central among these are Chevreau (2006) and Oxstrand and Sylvander (2010). The former has argued that safety culture itself was a 'rational myth'; the development of safety culture required a number of processes and practices such as defined work procedures, audits of management systems, performance management systems, opportunities for learning and sharing and involvement of workers, including their adaptations (Chevreau, 2006). This author goes on to argue that: '…studying resilience in organisations allows us to understand some very important adaptation mechanisms but, as the notion of safety culture has already been adopted by researchers and scientists, why should we replace it' (Chevreau, 2006, p. 9). Chevreau thus argued against the replacement of safety culture with RE. On a similar note, Oxstrand and Sylvander (2010) argued that, 'from a Nordic perspective RE was not much more of a relabelling of [well known] concept of safety culture' (Oxstrand & Sylvander, 2010, p. 136). For both these authors some of the notions associated with RE were already included in the ideas of safety culture, so there was no need for the latter.

These authors at least agree that some of the things deemed necessary for RE are also required for safety culture. However, there is still no consensus about what safety culture was or is (Choudhry et al., 2007b; Guldenmund, 2006; Hopkins, 2006) even after many years of research and practice, despite a similar point being raised over a decade ago by Guldenmund (2000). Whether such a consensus is necessary or not is, in my view, more of an academic debate. As a practitioner in safety, I am a proponent of both safety culture and of RE. I see them as part of a continuum of approaches for improving safety, so both are necessary. I am more inclined to thinking of safety culture as an 'interpretive device' (Höpfl, 1994); i.e., safety culture can be used to interpret RE, and therefore acts as a tool for examining, exploring and/or measuring RE.

In addition to culture, another dimension that has been published involves cognition.

2.4.3.2 Cognitive Dimensions

Lengnick-Hall and Beck (2005) introduced cognitive resilience in the management arena as 'a conceptual orientation that enables an organisation to notice, interpret, analyse and formulate responses in ways that go beyond simply surviving an ordeal' (Lengnick-Hall & Beck, 2005, p. 750). According to these authors, organisations with developed cognitive resilience stimulated imagination and looked for newer opportunities and the development of skill sets, instead of relying on standardisation and controlling ways of working (Lengnick-Hall & Beck, 2005). In a later article these authors extended their definition to include 'organisational capability that assists an organisation to notice, interpret, analyse and formulate responses to unfamiliar situations, generating and providing alternatives for actions and encouraging decisive actions' (Lengnick-Hall & Beck, 2009, p. 49). The authors argued that strong, ideological identity and sense-making were two of the most important sources of cognitive resilience in organisations. Citing the works of authors such as Dutton and Jackson (1987), Collins and Porras (1994) and Freeman et al. (2004), the authors contend that organisational identity was reflected in the language, demeanour and style an organisation projected, which subsequently influenced how these were subsequently addressed (Lengnick-Hall & Beck, 2005, 2009). Furthermore, citing Thomas, Clark and Gioia (1993), Weick (1995), Aitken and Morgan (1999) and Mallak (1998), the authors suggested that sense-making involved 'the reciprocal interaction of information seeking, meaning ascription' (Lengnick-Hall & Beck, 2005, p. 750), which enabled resilient organisations to 'interpret and provide meaning to unprecedented, situation-specific events and conditions' (Lengnick-Hall & Beck, 2009, p. 45). These authors contend that cognitive resilience could be closely associated with requisite imagination (Adamski & Westrum, 2003), acquisition of error wisdom in organisations (Reason, 2008) and collective mindfulness (Hopkins, 2009a; Weick & Sutcliffe, 2007; Weick et al., 1999), which when combined together encouraged resilient organisations to motivate, perceive opportunities amid disaster and release unexpected physical and psychological resources (Lengnick-Hall & Beck, 2005, 2009).

In essence, cognitive resilience promotes flexibility in organisations by encouraging innovation through newer ways of working and/or using existing resources in more novel and imaginative ways, by using existing resources and strategies in amplifying the way they can be utilised. Earlier on, I introduced cognitive artefacts (Johnsen & Nemeth, 2005; Norman, 1991), and I believe this is what engenders cognitive resilience.

Back et al. (2007) linked cognitive resilience with decision-making at the local level of day-to-day operations, arguing that identifying the strategies people used to support performance in everyday situations was useful in identifying behaviours that enabled people to recognise and adapt to changes, disruptions and surprises created by the system. If this is indeed the case, it suggests that cognitive resilience assists in driving behaviours and decision-making.

Back, Furniss, Hildebrandt, and Blandford (2008) posit that cognitive resilience could be decomposed at five levels of granularity, including (i) individual, (ii) small team, (iii) operational, (iv) plant and (v) industry, while Bracco et al. (2008) suggest that cognitive processing in individuals can be decomposed at three distinct levels, including skills (S), rules (R) and knowledge (K) as suggested by Rasmussen (1983), depending on the efforts necessary to make decisions in a range of situations. These authors further developed this framework to capture the seven indicators of resilient organisations proposed by Wreathall (2006).

Johannsson and Lindgren (2008) suggested a set of factors they propose could be used by engineers to assess a system's cognitive resilience. Four of these properties are aimed at detecting resilience and nine at adaptation. The aim of this, according to the authors, was to give those practitioners who had not followed the development of the RE movement a tool that complemented traditional methods. Moreover, they argued the main advantage with their tool was that assessments could be performed within a reasonable period of time and without much theoretical knowledge (Johannsson & Lindgren, 2008).

The above discussion has examined cognitive resilience; implicit in some of the discussion is the idea that cognitive resilience drove resilient behaviours. This dimension is discussed next.

2.4.3.3 Behavioural Dimensions

The idea that resilience is a behavioural characteristic arises from the definition of organisational resilience suggested by Vogus and Sutcliffe (2007), who linked it with positive adjustments. Lengnick-Hall and Beck (2009) associate behavioural resilience with established behaviours and routines that assisted an organisation learn more about a situation, implement new routines, and fully utilise its resources under disruptions, uncertainties and surprises in order to maintain longevity of operations. The authors posit that 'behavioural resilience results from a dynamic tension between behaviours that foster creativity and unconventional actions, and familiar and well-rehearsed routines that keep an organisation grounded…' (Lengnick-Hall & Beck, 2009, p. 46). According to these authors, there were four ways in which behavioural resilience could be engendered: (i) through learned resourcefulness, (ii) counterintuitive moves, (iii) useful habits and (iv) preparedness. Learned resourcefulness and counterintuitive actions combined to generate a complex and varied set of strategic actions that could be initiated to deal with emerging threats (Lengnick-Hall & Beck, 2009). When mobile resources were available, combining them with resourcefulness created options that expanded the range of possible future behaviours (Lengnick-Hall & Beck, 2009). In addition, combining 'useful habits with behavioural preparedness creates a foundation of rehearsed and habitual expert routines that ensure an organisations' initial and intuitive action response to any situation leads to options instead of constraints' (Lengnick-Hall & Beck, 2009, p. 49).

Another set of behavioural indicators, decomposed according to vulnerabilities experienced across the individual, small team, operational, plant and industry levels, has also been suggested (Back et al., 2008; Furniss, Back, Blandford, Hilderbrandt, & Broberg, 2011). These levels represent the socio-technical arrangement of organisational systems suggested by Rasmussen (1997, 1999). The vulnerabilities represent some of the threats and pressures that particular level of the socio-technical system is expected to face, while the markers act as indicators that can be used for examining the impact of the threats and pressures.

The last three sections have discussed the three main aspects of organisational safety that appear to have informed the RE debate thus far, which I have summarised in Figure 4. While the three dimensions appear as a discrete aspects and/or abilities they do not occur in isolation, as authors such as Back et al. (2007), Johannsson and Lindgren (2008), and Lengnick-Hall and Beck (2005, 2009) suggest. The connecting arrows between the aspects reflect the view that they are not mutually exclusive but are interrelated.

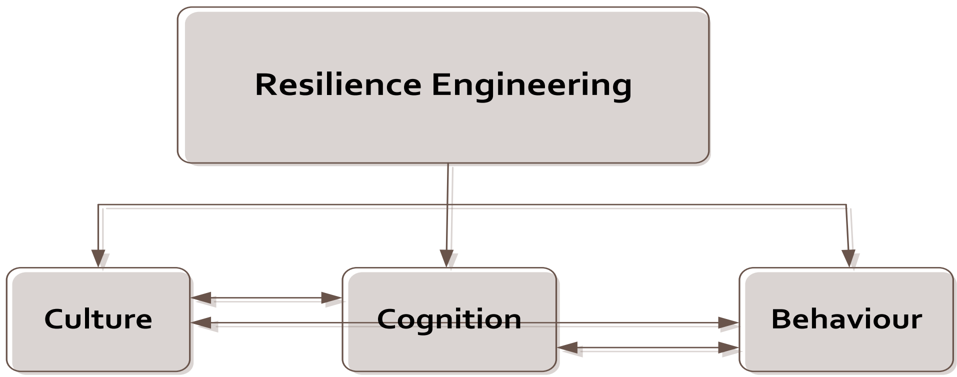

Figure 4: The Three Dimensions of RE

The above section discussed three dimensions of RE that have been used for RE research. Implicit in the discussion of behavioural and cognitive RE is the idea that it is distributed across a number of levels. In the next section, I review this dimension.

2.4.3.4 Levels

This dimension of RE is associated with the way it impacts a system at the different levels. An example of this, discussed above, was the way in which behavioural resilience is distributed across five levels.

One way of describing level is 'granularity', as suggested by Reason (2001), who posited that resilience manifested at operational, management and organisational levels, and that a matrix of indictors based on the 4Ps (philosophy, policy, procedures and practices) and the 3Cs (commitment, cognisance and competence) could be used to map and describe what a resilient and safe organisation was likely to look like. McDonald (2006) provided a similar decomposition at three layers, including operational, organisational and industrial. Woods (2006a) refers to 'cross-scale interactions' of upward and downward resilience. Citing previous works by Woods et al. (1994) and Woods (2005), he suggested that downward resilience included clear goal structures, infrastructure and procedures, which were impacted by 'how organisational context creates or facilitates resolution of pressures/goal conflicts/dilemmas' (Woods, 2006a, p. 23). Citing Cook et al. (2000), he suggested upward resilience included decisions made at the micro-level, which were influenced by 'how local adaptations by local actors in [the form of] workarounds or innovative tactics reverberate and influence more strategic goals and interactions' (Woods, 2006a, p. 23). Here, it would appear that Woods is alluding to ways in which workers at the sharp end of risk try to maintain a balance between the two conflicting goals of safety and production, while (Hollnagel, 2009a) associates this with maximising the efficiency thoroughness trade-offs.

Tjørhom and Aase (2011) explored cross-level interactions (upward and downwards resilience) across the different levels (legislative, regulatory and operations) and three different work domains (air traffic control, airport operations and airline maintenance (Tjørhom & Aase, 2011). The authors focused on safety, management commitment to safety, change and prioritisation for safety. These researchers concluded that their studies revealed a lack of commitment in the aviation sector to downward resilience at the macro level, which was caused by conflicting objectives of being safe and serving the community; these were counterbalanced by upward resilience through a clear commitment to safety, sacrificing decisions made in favour of safety and establishing resource buffers for handling safety in critical situations.

Furniss, Back, Blandford, et al. (2011), building on the earlier works of Back et al. (2008) examined resilience at the 'small team level' through an experimental case study in the NPP. The authors suggested their framework was a first step towards the development of more concrete measures for improving organisational resilience through training, system design and organisational learning (Furniss, Back, Blandford, et al., 2011). Furniss, Back, and Blanford (2011) revised this framework and used it to examine the behaviour of normal work operations in the healthcare sector. The study revealed a range of strategies used to keep the Day Care Unit working efficiently, effectively and safely in spite of the vulnerabilities and threats experienced in the unit, including (i) guarding against errors when programming two infusion pumps in parallel and programming the trolley, (ii) managing workload pressures through the refusal of new patients, (iii) managing internal deviations (agency staff not aware of normal practice, and (iv) planning for potential power outages (Furniss, Back, & Blanford, 2011). The authors concluded their framework was useful in identifying, exploring and describing these behaviours in a range of small work contexts. However, the main difficulty arose from the fact that there was not yet a fully developed taxonomy of markers, strategies and associated observations which could be used as a reference points (Furniss, Back, & Blanford, 2011). This study reveals that research on RE need not be limited to examining recovery during catastrophic events; it could also be examined in everyday work in normal work settings. From a methodological point of view, this research suggests 'episodes' of resilience (Furniss, Back & Blanford, 2011) can be observed and analysed at micro-levels such as hospital trolley and infusion pumps.

The above section has reviewed four main characteristics that appear to have informed the RE debate thus far. The review suggests these characteristics are distributed across a number of different levels, including industrial/sectoral and organisational. At the latter level, these can be further distributed at managerial and operational/plant levels; moreover, manifestations of RE capabilities can be evident at individual and small team levels. The literature also suggests that an organisation's collective cultural, cognitive and behavioural attributes can be further decomposed into a skills, knowledge and rules matrix and used for driving safety at the operational level. These expanded dimensions of RE as distributed across the different levels of an organisation are illustrated in Figure 5.

An analysis of the literature also suggests there are many factors, indicators, and/or measures that have been used for operationalising RE. However, among the many measures the gap between work as imagined and work as performed has been suggested to be an important one. The reminder of this review examines this measure to develop a working definition of RE and a conceptual model that may be useful for conducting research on SWMS and RE.

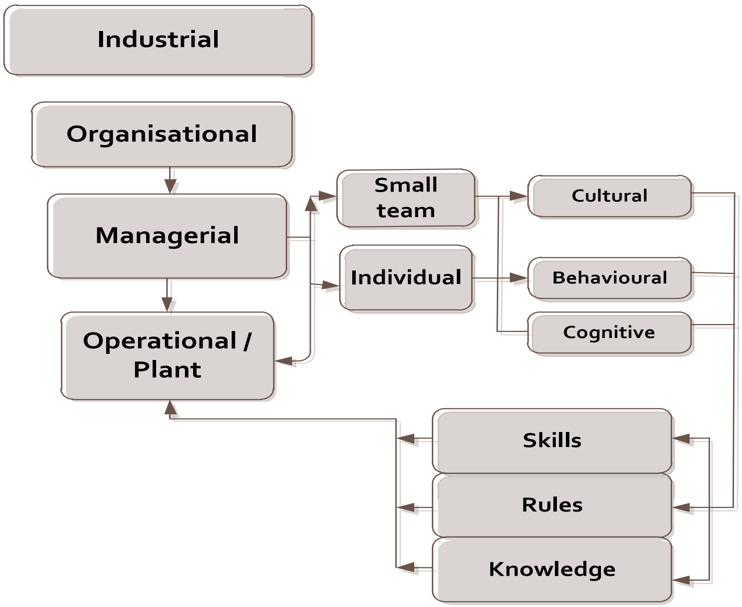

Figure 5: Distributed Dimensions of RE

2.4.3.5 The Gap between Work as Imagined and Work as Performed

The notion of the gap between procedures and safety was first alluded to by Dekker, who argued that one way in which organisations could advance safety through procedures was to 'monitor the gap between procedure and practice and try to understand why it exists' (Dekker, 2003, p. 236). In a later article where he discussed his thinking on RE, Dekker (2006) suggested 'one marker of resilience…is the distance between operations as management imagines they go on and how they actually go on' (p. 86). Hollnagel and Woods make a similar point, stating 'it is fundamental for RE to monitor and learn from the gap between work as imagined and work as practised' (2006, p. 357). However, these authors contend that conceptualising and examining such a gap poses a real practical problem.

There appear to be some advances being made in this regard, with conceptual papers published by researchers such as Cook, Render and Woods (2000), Branlat and Woods (2010), Hofman and Woods (2011) and Woods and Branlat (2011), while empirical research studies have been conducted by authors such Abech et al. (2006), Antonsen et al. (2008), Borys (2009, 2012), Costella et al. (2009), da Mata et al. (2006) and Huber et al. (2008).

Cook, Render, and Woods (2000) contended that the gap between work as imagined and work as performed mark 'the areas of vulnerability and show the mechanisms by which complexity flows through [healthcare] to individual patients' (Cook et al., 2000, p. 794). The authors suggested that further work on such gaps needed to concentrate on three key issues: (i) a catalogue of gaps, (ii) understanding how practitioners anticipated, detected, and bridged these gaps and (iii) discovering how gaps are created by organisational and institutional change (Cook et al., 2000). Recent years have seen attempts to address the first two of these issues.

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Authors such as (Hofman & Woods, 2011) and Woods and Branlat (2011b) characterised the different types of gaps that may exist, the ways in which they could be manifested and the ways in which they could be narrowed. They classified these gaps as (i) fitness, (ii) plans, models and procedures, (iii) perspectives, (iv) roles and (v) progress.

Gaps in fitness arise because designers cannot completely design out all hazards and risks; there will always be a struggle for fitness, and this can be narrowed through resilience or more specifically, adaptation (Woods & Branlat, 2011b). *Gaps in plans, models and procedures* arise due to limitations in human capacity to design systems that are ultra-safe, mainly because it is impossible to identify all hazards and risks; one's cognitive ability limits what can be perceived and/or anticipated (Hofman & Woods, 2011; Woods & Branlat, 2011). Such gaps create an opportunity for learning in organisations (Hofman & Woods, 2011). A third type of gap is that of *perspectives,* which arises because people, at any intellectual level, occupy a point of observation relative to the world in which they are embedded (Hofman & Woods, 2011). This view, according to the authors, partially obscures and obstructs aspects of the world. Such a gap creates an opportunity for reflection, and narrowing this requires one to make trade-offs between acute and chronic or goals (Hofman & Woods, 2011).

Organisational systems are divided into different levels and components, each of which play their own separate roles in the overall system (Woods & Branlat, 2011b). It then follows that the responsibility and risks associated with achieving or failing to achieve them are divided across the different levels and components (Woods & Branlat, 2011b). What this means is that all parts of the system are pursuing multiple goals; in doing so, they may cooperate to achieve shared goals and compete when goals conflict (Woods & Branlat, 2011b). What results are *gaps in responsibilities/roles*, and one way of addressing these gaps is to coordinate between and across the different levels of the system (Hollnagel, 2009a).

A gap in progress is closely associated with gaps in effectiveness. 'Organisational systems are restricted in the ways they can act and influence situations; no controller is omnipotent' Hofman & Woods, p. 20). As the authors argue, because it is likely that there is some potential for surprise, all systems need to balance distant plans with local adaptations to fit their responses to the actual conditions, in order to make progress towards achieving the goals. Hence, there are multiple centres of control working in parallel, each of which are bounded in terms of their scope of authority in meeting sub-goals within the context of other centres (Hofman & Woods, 2011). Moreover, many of these local centres are sensitive to sources of variability, giving them privileged ability to pick up on surprises, disruptions, and opportunities to plan progress, while the more distant centres of control provide broader perspectives over time, space, and multiple functions; enabling them to coordinate activities in order to achieve broader, organisational level goals under tighter pressures (Hofman and Woods, 2011). Such gaps, according to these authors, could be addressed through adaptations at the local level.

These five types of gaps and ways of narrowing them are illustrated in Figure 6.

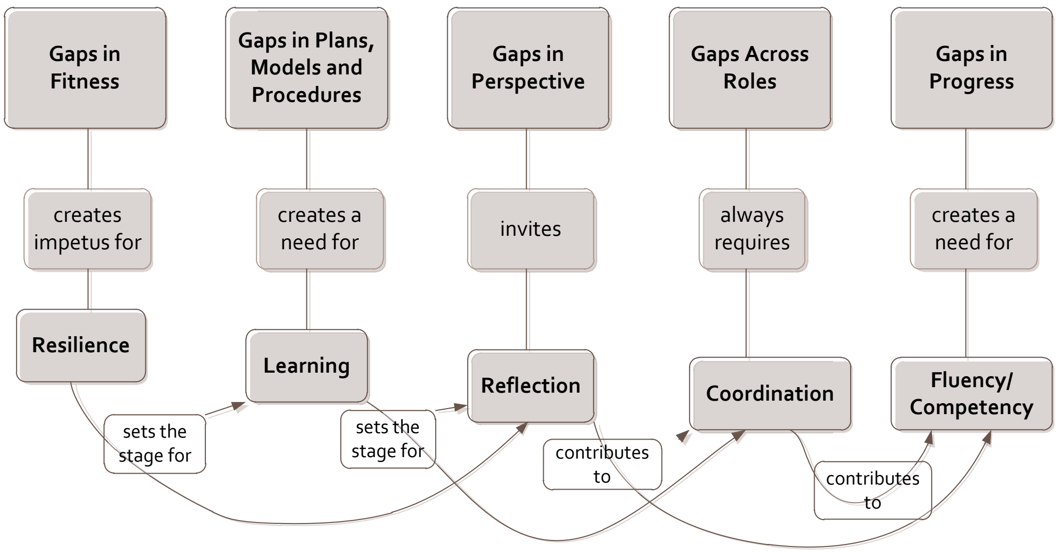

Figure 6: Five Types of Gaps and Opportunities for Narrowing Them

Adapted from Robert and Hofman (2011)

The above papers are largely conceptual in nature, and empirical evidence of their actual existence and/or how they are actually addressed in reality appears to be unexplored, at least at this stage. What is the extent to which these types of gaps would be revealed by an examination of SWMS, and how would such gaps be addressed in reality? This is one of the questions that can be explored through research.

A number of authors have explored the gap between work as imagined and work as performed in a range of contexts, including oil and gas distribution, aviation, contract maintenance, automotive, healthcare and construction.

Abech, Berg, Delis, Guimeraes, and Woods (2006), investigated how an oil distribution company adapted when events challenged its model of how it should operate. Five researchers spent a period of four months to explore how closely operators depended on written plans and procedures when dealing with regular, irregular and unexampled threats (Epstein, 2008; Westrum, 2006). Data was collected through observations and interviews with operators. The research revealed gaps in communication between operators, truck drivers, and between operators and truck drivers, and risk control measures such as signals and correct signage, risky tank-filling work practices and insufficient engineering controls for overflows (Abech et al., 2006).

This research focused on the operator's ability to deal with everyday events and threats, extending the scenarios to unexampled threats in the form of future incident scenarios, which the researchers generated as part of the research process. One of the shortfalls in this study was limiting the interviews to the operators; hence, the data collected were mostly at the level of work as performed. Extending the interviews to other actors in the system would provide richer data on work as imagined as well.

Antonsen, Alkmklov, and Jorn (2008) conducted a case study to investigate conditions that facilitated compliance with procedures in a Norwegian offshore supply base. Data for this study were collected through a self-administered questionnaire (issued to 98 employees with a return rate of 80%), and triangulated with semi-structured interviews with 28 key informants. This study revealed that simple and accessible procedures had a better chance of being used, and ensuring a broad and direct participation of workers in implementing the procedures was seen as an ingredient for greater commitment and adherence to the procedures. The authors concluded that addressing the gap between work as imagined and work as actually done served as opportunity for learning, which the authors suggest was a prerequisite for building organisational resilience (Antonsen et al., 2008). The authors acknowledge, however, that eliminating the gap completely was impossible because there were an indefinite number of local situational variations in the work context they had investigated.

This was largely an evaluative study of a change management initiative implemented in the organisation. The use of mixed methods is a novel way of addressing many of the criticisms of single methods based on either qualitative and quantitative studies, according to authors such as Johnson, Onwuegbiz and Turner (2007) and Sale, Lohfeld and Brazil (2002). However, this requires the researcher to be well versed in both qualitative and quantitative approaches and methods (Creswell, 2009).

da Mata et al. (2006) investigated constraints in a Brazilian helicopter transportation system, the mental mode of pilots and factors that played a role in their decision-making when coping with unexampled threats, multiple pressures and goal conflicts. The researchers interviewed 13 key participants, including co-pilots (7), operators (2), captains (20), a psychologist and a human resource analyst over a period of six months (da Mata et al., 2006). One of the shortfalls in this study concerns the limitations with data collection, which was through interviews only. Such data includes 'indirect information filtered through the views of interviewees' (Creswell, 2009, p. 179), which could cause bias in the data. This could be addressed through data triangulation, by extending data collection approaches such as documents and/or observations (Patton, 2002; Stake, 1995).

Borys (2009) explored the impacts of risk awareness programs on workers' awareness of risks, risk control practices among workers and managers, and their impact on safety culture. He used ethnography (Atkinson & Hammersley, 1998; Hammersley, 1998) and document analysis, key participant observation and semi-structured interviews with workers (19) and managers (7). Among other findings, the study revealed that there were gaps between the paperwork and practice, creating an illusion of safety for workers and managers (Borys, 2009). Borys concluded that an understanding of how work is actually performed was important for managers to develop safety rules that were grounded in reality. In a more recent study, he investigated how managers and workers interpreted and used SWMS in the Australian construction industry in order to explore if there was a gap between work as imagined and work as performed. Data was collected through 18 interviews involving labourers, supervisors and managers at two commercial construction sites in Victoria, Australia. This was triangulated with completed SWMS (Borys, 2012). The study revealed that SWMS were important for safety but that informants felt it should be reserved for tasks that were out of the ordinary; and that a combination of formal and informal social interactions as well as SWMS was important for safety. Borys (2012) identified three different types of gaps, which he characterised as compliance, adequacy and competence.

The ethnographic approach used in the above studies is useful as a research strategy for investigating culture. However, a drawback with ethnography is that it can be very time consuming. 'Historically, ethnography means long periods of fieldwork—a minimum of a year and preferably two or more' (Handerker, 2001, p. 4). Another shortfall of this study was that it was limited to one organisation, and concentrated on actors internal to the organisation. No contractors or subcontractors were interviewed. Much work in construction is done by subcontractors (Loosemore & Andonakis, 2007; Wadick, 2005, 2010); and they are also expected to be the ones to bear the burden of responsibility (Bhattacharjee et al., 2011). Hence, extending data collection to this group will provide a greater insight into the understanding and practice of SWMS on the shop floor.

Costella et al. (2009) conducted an RE audit of a Brazilian automobile exhaust systems manufacturer to examine how well the set of four variables: top management commitment, awareness, learning and flexibility, were embedded in the organisation. The audit tool included a 112 point audit checklist, of which 38 items were linked to these four principles earlier developed and tested by Saurin, Costella et al. (2008). The study identified a lack of commitment to safety by management and some flexibility in decisions to cease operation of unsafe equipment being delegated to safety specialists (Costella et al., 2009). Another sign of flexibility lay in empowering the production manager to relocate workers away from machines that had been involved in an accident or where operators had raised concerns regarding dangerous and faulty machines to other tasks (Costella et al., 2009). The authors suggested ambiguities about responsibility for decision-making for shutting down dangerous plant signified production management being unaware of how to trade-off between safety and production; and the difference between organisational level policies and site practices were not monitored, which suggested a further symptom of failure to learn by the organisation (Costella et al., 2009).

Huber et al. (2008) conducted a similar audit in a European chemical manufacturing company to investigate organisational learning. A team of seven researchers collected data through field observations and interviews with 49 people, comprising operators (28) and managers (21). The researchers found daily trade-offs between production and safety, making it difficult to achieve safety goals ahead of production, and normalisation of small accidents and incidents, which were not reported or investigated. Therefore, these did not form part of the accumulated learning process in the organisation. In addition, there were in excess of 40 (overall) procedures and between 30–40 local ones that were used as guidelines or suggestions. Many of the procedures had not been updated. Incident reports were collected and memos about the incident placed on the intranet instead of being discussed at team meetings; this meant that learning from failures was not used for improving performance. Furthermore, there were always gaps between written guidance and actual practice, and so the real challenge in the organisation lay in being sensitive to this gap (Huber et al., 2008).

2.4.3.6 Summary

The above analysis of published research on RE suggests the following at this point of the review:

First, there is no universally definition of RE (Dekker, 2006; Sheridan, 2008; Pillay et al., 2010). Hence, there is no uniform way of assessing, examining, or observing it. Second, it is a theoretical construct, not a concrete element, substance or entity that can be touched, felt or smelled. Third, it is multi-dimensional (Hamel & Valikangas, 2003; Lengnick-Hall & Beck, 2009). Common dimensions used for exploring and/or measuring RE include culture (e.g. Wreathall, 2006; Flin, 2006; Woods, 2006a), cognition (Furniss et al, 2008, 2011; de Carvalho, et al., 2006); behaviour (Seville, 2008) upward and downward cross-scale interactions (Woods, 2006a), individual, small teams operational, plant, industry (Back et al., 2008; Furniss, Back, Blandford, et al., 2011; Furniss, Back, & Blanford, 2011), and organisation (Back et al., 2008; McDonald, 2006). Fourth, it is associated with a dynamic, not a static state (Hollnagel, 2006; Hollnagel & Sundström, 2006). Fifth, it is associated with balancing safety and performance so that both can be achieved simultaneously (Hollnagel, 2009a); the key being that such balancing takes into account higher-order organisational level goals, even if this meant sacrificing shorter term goals (Cook & Nemeth, 2006). At the operational level, this is achieved by workers continuing to operate as normal. Sixth, the gap between work as imagined and work as performed is important for RE.

In order to advance research in RE, it is important to develop a definition that can then be used for establishing a boundary around RE research. In the following section, I provide a working definition.

2.4.4.7 A Working Definition of RE

For the purpose of this thesis my proposed working definition is:

RE is a sophisticated way of managing organisational safety through the development of cognitive, behavioural, and cultural abilities to enable organisational members at all levels to actively anticipate, respond, monitor, and learn to operate close to the boundary of safe operations as part of normal work, by narrowing the gap between work as imagined and work as performed.

Framing RE in this way makes a number of things clear. One, RE is about organisational safety, not individual safety. Two, it incorporates the cognitive, behavioural and cultural aspects of an organisation, so research on RE can be directed at any or all of these aspects. Three, although an individual can have all these attributes, it is only when they are collectively distributed across all levels of the organisation that these play a role in RE. Four, the above collective aspects enable the organisation collectively to anticipate, respond, monitor and learn. Five, RE is about operating as closely as possible to the boundaries of failure as part of *normal work*. This means that research on RE should entail normal, not simulated, work. Six, the gap between work as imagined and work as performed is an important facet of RE.

The last two aspects are the focus of this thesis; i.e., research in normal construction settings, with the focus being on the gap between how work is imagined and how it is actually performed. The premises of this thesis is that seeking to understand whether SWMS enhanced or impeded RE in construction involves examining this gap in a construction context. Safety rules, according to Hayes (2009), form part of the safe operating envelope. Hence, as a set of safety rules SWMS represent the boundary of safe operations in construction. Monitoring how managers, supervisors and workers interpret and use SWMS, and the circumstances under which work practices depart from prescription may therefore provide important clues regarding how an organisation adapts to achieve safety and avoids drifting into failure. Moreover, understanding the different types of gaps that exist in the system will provide clues about what makes the construction system brittle.

2.5 EXPLORING THE GAP BETWEEN WORK AS IMAGINED AND WORK AS PERFORMED

The purpose of this literature review was to locate the 'gap between work as imagined and work as performed' as an important indicator within the broader RE literature. Following a review of health and safety management in construction and safety rules, I chartered the landscape of RE, before unpacking the definitional issues surrounding organisational resilience and RE. I then reviewed the published literature on RE from the functionalist and interpretive perspectives, followed by a discussion of key dimensions and measures that appear to have informed the RE debate to date. Finally, the notion of the 'gap between work as imagined' was analysed by examining the contexts in which it has been explored, the methodologies applied and some of the limitations of these.

In the next section, I identify the gaps in the literature on construction safety management, safety rules and RE. I also discuss how this research will address some of these gaps, then present a conceptual framework and use this to conclude this section with the set of revised questions that inform this thesis.

2.5.1 GAPS IN THE LITERATURE

The three fields or literature reviewed in this section suggest there are a number of gaps in relation to construction health and safety management, safety rules and RE.

First, in relation to construction health and safety management, empirical studies associated with the utility of safety rules in the construction industry is lacking. In spite of this, regulators in Australia have opted to resort to this, in the form of SWMS, as a broad strategy for managing health and safety risks in the industry. *Empirical evidence of the effectiveness (or otherwise) of SWMS or of its contribution to health and safety in construction is missing from the literature* (Borys, 2012). While many safety practitioners would argue that safety rules could bring about improvements in health and safety performance, evidence suggests that exclusive and intensive use of procedures is more likely to act as a threat towards progressing safety (Hale & Borys, 2012a, 2012b).

Second, even where safety rules have been known to be effective, current evidence suggests that monitoring and adaptation are central to safety management (Hale & Borys, 2012a, 2012b). However, *empirical evidence of the extent to which such adaptations actually occur in construction is missing from the literature* (Saurin, Formoso, et al., 2008).

Third, the analysis by domains of published research in this review suggests that current research on RE has largely been carried out in complex workplaces, typically described as 'tightly coupled and interactively complex' (Perrow, 1999; Pitzer, 1999). However, *empirical studies on RE from the construction domain are missing from the literature*, although propositions for such research have been suggested (Schafer, Abdelhamid, Mitropoulos, & Howell, 2008;

Schafer, Abdelhamid, Mitropoulos, & Mrozowski, 2009). This represents a significant gap in our current knowledge, and addressing this will be an important first step in understanding whether RE is a useful approach in driving health and safety improvements in construction further than what has been achieved.

Fourth, most research appears to have been limited to examining single units or levels of organisational systems (Størseth, Albretschsen, et al., 2010; Størseth, Tinmannsvik, et al., 2010). This, I believe, represents a significant gap in the literature, because *safety, at least on the level where work is done at the sharp end of risk is likely to be influenced by other levels*, such as managers, supervisors, associations and government (Rasmussen, 1997; Rasmussen & Svedung, 2000).

Fifth, while the published papers provide a rich source of information on concepts, ideas and notions associated with RE, *many of the papers lack a suitable conceptual and theoretical framework*. More specifically, *an adequate theoretical framework for examining the gap between work as imagined and work as performed is lacking in the literature*. Again, I believe addressing this gap is crucial for advancing research and practice in RE.

2.5.2 TOWARDS A RESEARCH QUESTION

The purpose of this study is to gain an understanding of whether SWMS enhance or impede RE as a health and safety management strategy in construction organisations. Based on the literature review, this aim can be expanded into a central research question.

2.5.2.1 The Central Research Question

Do SWMS enhance or impede RE as a health and safety risk control strategy in the Victorian construction industry?

The key premises of this thesis is that seeking to understand whether SWMS enhance or impede RE in construction will provide clues about its utility as a risk control strategy. By exploring how managers, supervisors and workers interpret and use SWMS, and the circumstances under which work practices depart from prescription may therefore provide important clues regarding how an organisation adapts to achieve safety and avoids drifting into failure. Moreover, understanding the types of gaps that currently exist will provide clues about what makes the construction socio-technical system brittle, while gaining an understanding of the approaches that are currently used for managing SWMS can give an indication of how these can be adapted to drive RE more proactively.

In the following section, I propose a conceptual framework which I subsequently use to refine my central research question into a series of sub-questions.

2.5.2.2 A Conceptual Framework

According to proponents such as Dekker (2006), Hollnagel and Woods (2006) and Wreathall (2006), fostering RE involves obtaining an understanding of *how work is actually performed by workers operating at the sharp end of the risk* [emphasis added]. This means understanding how work practices actually evolve in normal work settings, amid everyday hazards, threats and multiple goals (Rasmussen, 1997; Woods & Hollnagel, 2006), and comparing it with work how is imagined (or prescribed) according to management. One way of explaining this is provided by Nathanael and Marmaras (2008a, 2008b), who elaborated on the relationships between prescription and practice and discussed how their complex interactions influenced resilience in a positive or negative manner. According to these authors, prescriptions represented the intentions of management that were communicated within organisations as policies and procedures, with the aim of controlling people's behaviour (Nathanael & Marmara, 2008b). However, in normal work people did not accept these top-down prescriptions and use them as a particular course of action, but saw them as a constraint to their normal way of working, which led them to derive their own meaning of how the prescription was to be applied (Nathanael and Marmaras, 2008 a,b). The authors proposed the Prescriptions–Repetitions–Distinctions–Descriptions (PRDD) as a useful way of describing the development of prescriptions and the practise of work in organisations (Figure 7).

According to this model, the development of prescriptions and the practice of work in organisations can be conceptualised as a series of four interconnected loops, and which could be decomposed at two broad levels. The top level includes the prescriptions loop, which is largely about the organisation's goals and intentions and the expressions of these as policies, standards, procedures and/or work instructions (Nathanael & Marmaras, 2008b). These are generally not grounded in reality (Nathanael & Marmaras, 2008b) but derived from management and engineering thinking (Schein, 1996) and 'communicated downwards as (i) assigned responsibilities, (ii) specific objectives, and (iii) norms, standard operating procedures, task descriptions and physical descriptions of work,' hence were 'an attempt to formalise practice' (Nathanael & Marmaras, 2008b, p. 111). This could be equated with 'work as imagined' (Dekker, 2006; Hollnagel & Woods, 2006; Nemeth (2006).

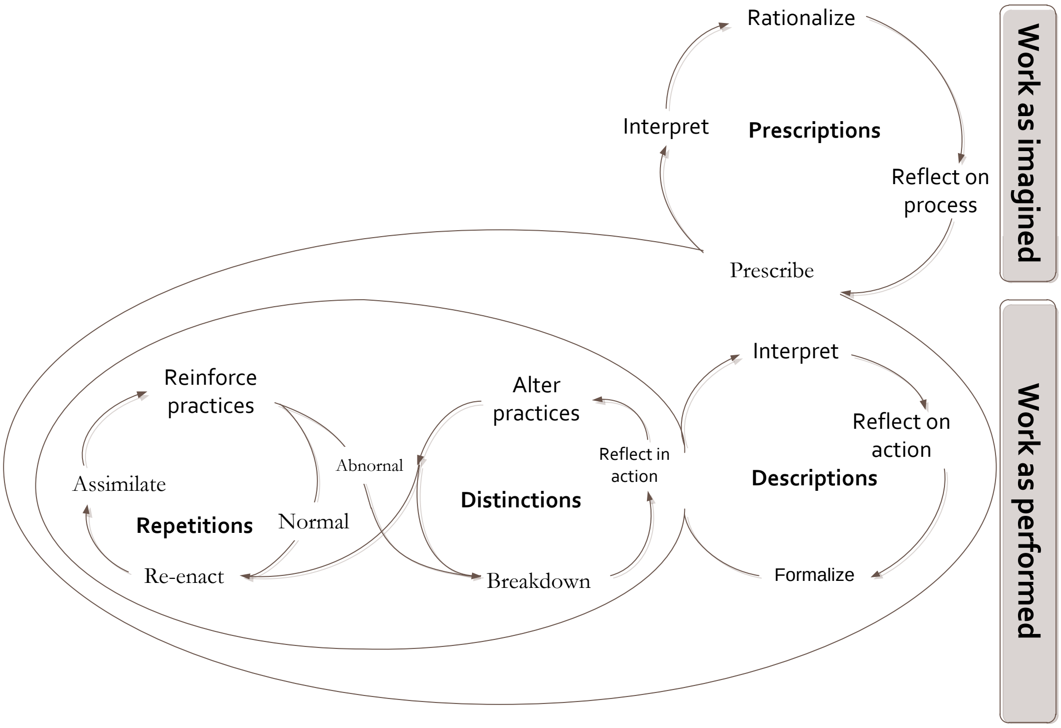

Figure 7: The PRDD Model

Adapted from Nathanael and Marmaras (2008b)

The lower level is about how work is actually done, and represents how work is actually performed, or the normal ways of things as they actually occur at the sharp end of risk. It has been conceptualised as evolving through a series of double loops, one encapsulated inside the other with each loop unfolding at different times (Nathanael & Marmaras, 2008 a,b), and can be equated with 'work as performed' (Dekker, 2006; Hollnagel & Woods, 2006; Nemeth, 2006).

The repetitions loop involves the development of safe work habits, reinforced through 'local feedback loops' (Dekker, 2006; p. 89) or 'habits,' while the distinctions loop represents their 'situated challenging when, after a breakdown, members distinguish new types of situations and/or new ways to act' (Nathanael & Marmaras, 2008b, p. 106). These different scenarios trigger RIA (Schön, 1983) leading to modifications in practice that are subsequently immersed into the prescriptions cycle. The descriptions loop provides an impetus for purposeful and detached reflection because groups do not act only in the present but also observe themselves and others by placing their identity outside of their evolving work experience and reflecting upon it (Nathanael & Marmaras, 2008a). This ROA, according to Schön (1983) is disconnected from experience and results in groups generating their own interpretations of their actual work and formalising this through rational dialogue (Nathanael & Marmaras, 2008a).

According to these authors, successful adaptation depends on the organisation's ability to provide a stable basis for interpreting and formalising the descriptions through ROA It is not necessary for organisations to make the prescription and practice it, nor is it necessary to 'impose top-down prescriptions blindly or ignore descriptions produced by work communities through reflection-in-action' (Nathanael & Marmaras, 2008b, p.117).

The PRDD is a useful conceptual model that can be used to examine the gap between work as imagined and work as performed through SWMS by refining the central research questions and establishing a focus for research on SWMS and RE.

2.5.2.3 Refining the Research Questions

The central research question this thesis seeks to answer is:

Do SWMS enhance or impede RE as a health and safety management strategy in the Victorian construction industry?

This research question acknowledges that understanding whether SWMS impede or enhance RE is essential to understanding their utility as a health and safety risk management strategy in the Victorian construction industry.

In order to answer the above question, a series of sub-research questions can be posed, in line with the ideas expressed in the PRDD model:

1. *How are SWMS prescribed, and how are these prescriptions interpreted?*

Prescription, according to Nathanael and Marmaras (2008 a,b), is a rational description of what needs to be done and how, and conveys the intentions of upper level management. Therefore, this question aims to explore the objectives managers assign to SWMS.

2. How are SWMS experienced in practice?

According to the PRDD model, people do not necessarily accept a prescription, but may see it as a constraint to their normal ways of working, causing them to derive their own interpretation of how the prescription is to be applied (Nathanael & Marmaras, 2008a). This question therefore aims to start exploring the practice of SWMS.

2.1 To what extent are the practices of SWMS re-enacted, and how may this be assimilated into a work group?

Re-enactment has been suggested to occur in the repetitions loop (Nathanael & Marmaras, 2008a), and this question explores the extent of re-enactment that is likely to take place.

2.2 To what extent are the practices of SWMS reinforced into a work group?

Reinforcement of practices has been suggested to occur in the repetitions loop (Nathanael & Marmaras, 2008a), and this question explores the extent to which reinforcement is likely to take place.

2.3 To what extent are distinctions experienced in SWMS?

Apart from repetitions, work groups have the unique ability to change their ways of acting in the face of unexpected external events and subsequently generate new distinctions, as work communities experience activity in different ways (Nathanael & Marmaras, 2008a). This question explores unexpected events (both external and internal) that may generate distinctions in SWMS practice.

2.4 To what extent does this distinction alter the practice of SWMS?

Through cycles of breakdowns in routine practice and subsequent RIA, people in work communities distinguish new situations, enrich and share their experience and progressively enhance or modify their assimilated practices (Nathanael & Marmaras, 2008a). This question explores breakdowns and RIA at the work group level, and how this may enhance or modify the practice of SWMS.

2.5 To what extent are the practices of SWMS formalised by a work-group?

Work groups not only act in the present but also observe themselves and others, place their identity outside of their evolving work experience and reflect on it; and this formalisation involves standardising and re-arranging practice (Nathanael & Marmaras, 2008a). So this question aims to explore the extent to which SWMS are likely to be formalised by a work group, particularly in relation to work for which there is no formal prescription.

2.6 To what extent does a common description of SWMS arise out this formalisation?

According to the PRDD model, through cycles of descriptions work groups progressively build a rationalised account of their proper practice, stimulating reflection and/or discourse between members which often goes well beyond sharing experiences and theorising about them, through which new interpretations may arise (Nathanael & Marmaras, 2008a). This question therefore attempts to explore the extent to which any common description and/or a new interpretation of SWMS develops any reflection and discourse between the practitioners of SWMS, and how rationalised accounts of the practice of SWMS are presented by the work group.

2.5.3 SUMMARY

In this section, I have reviewed the literature that informs this thesis. The review revealed a number of gaps relating to the efficacy of SWMS, rules and RE that creates knowledge gaps between RE and its application in construction. A conceptual model for examining whether SWMS impede or enhance RE as a health and safety strategy in construction industries was also derived from the literature. In the next chapter, I discuss the theoretical and research frameworks that will underpin how the research questions will be addressed.

CHAPTER 3: RESEARCH AND THEORETICAL FRAMEWORK

3.0 INTRODUCTION

In the last chapter, the existing literature on RE research was synthesised to derive a conceptual framework for investigating the gap between work as imagined versus work as performed. This was then used to refine the central research question into a series of sub-questions that can be used to explore whether SWMS impede or enhance RE as a health and safety management strategy in the Victorian construction industry.

This chapter provides an overview of the main theoretical and philosophical considerations that inform this thesis. I first discuss the theoretical framework of my research by revisiting the foundations of academic research through a discussion of research paradigms, epistemologies, theoretical frameworks, methodologies and data collection methods; a modified version of the framework suggested by Crotty (1998). I then examine one research methodology, case study, more closely, and argue why it is a suitable for gaining an understanding the role of SWMS in the Victorian construction industry. The chapter concludes with some reflections on this aspect of my research journey.

3.1 RESEARCH FRAMEWORK

According to Crotty (1998), using an appropriate research framework involves choosing an appropriate research epistemology, theoretical framework and a research design that is consistent across them. However, on a broader level, this also is about ensuring these are also embedded within the appropriate research paradigm, so I briefly visit this aspect first.

3.1.1 RESEARCH PARADIGMS

A research paradigm is essentially a shared set of beliefs that governs the types of knowledge that researchers seek and the way they go about collecting the data (Crotty, 1998; Morgan, 2007). It represents 'worldviews' Creswell (2007, 2009) or a 'basic belief system or worldview that guides the investigation' (Guba & Lincoln, 1994, p. 105), 'an overarching conceptual construct, a particular way in which scientists make sense of the world or segment of the world' (Crotty, 1998, p. 35). As such, paradigms are used to establish the parameters and set boundaries for conducting academic research. A number of paradigms are commonly used, including positivism, interpretivism and pragmatism[5]. I have chosen these three because I believe they are the roots from which the other paradigms have been developed or derived.

3.1.1.1 Positivism

Positivism, traditionally known as empiricism, is a philosophical stance that suggests that truth and knowledge is based on a set of observable, objective facts (Creswell, 2009; Crotty, 1998). Positivism is derived from the natural and physical sciences and is characterised by testing hypotheses that are developed from existing theories and measured through observed realities. In the social study of management and organisations, according to Krauss 'it is the position that holds that the goal of knowledge is simply to describe the phenomena that we experience' (2005, p. 760). Most positivists are reductionists; they study things by breaking them down into smaller and simpler components. What they are essentially trying to do is replicate the rules and assumptions of the biological and physical sciences into the social sciences (LeCompte & Schensul, 1999). For positivists, knowledge is built up incrementally from observations of facts that can be verified, and from which and inferences can be drawn. Those engaging in positivist research commence with specific theories from which they derive hypotheses that are subsequently verified or refuted. For example, Hatch and Cuncliffe (2006) argue that what truly occurs in organisations can only be discovered through categorisation and scientific measurement of the behaviour of people and systems, and that language represents this reality.

Positivist researchers try to maintain objectivity by separating the conceptual and social divide between the researcher's influence and the objects or subjects being studied (Krauss, 2005; LeCompte & Schensul, 1999). In doing so they withhold their own biases and prejudices about the research and its participants, because to do otherwise may mean they

5 There are of other paradigms; Creswell (2007, 2009) suggests post positivism, constructivism, advocacy/participatory and pragmatism; while Hassard (1991) has suggested there are functionalists, interpretive, radical humanist and radical structuralist, arguing that each of this can be used with equal rigour to answer a research question.

are influencing the results and outcomes in some way. They do this because positivists believe that the methods they use to conduct research should be neutral and value-free, although they understand that the researcher's own values play a role in the selection of the research question (LeCompte & Schensul, 1999). Furthermore, they feel that their personal values could influence how their research is used, hence they remain disinterested in the actual conduct and outcomes of the research (LeCompte & Schensul, 1999). This is in contrast to other research traditions, such as interpretivism, which acknowledges that the researcher is not totally alienated from the research process, but is a participant in some form or other. In general, positivism is closely associated with research that involves quantitative studies. However, qualitative studies can also be based on this tradition (LeCompte & Schensul, 1999). In RE, studies published from the functionalist perspective are based on this paradigm, although these have not been acknowledged by their authors as such.

3.1.1.2 Interpretivism

Interpretivism, also known as 'naturalistic inquiry' (Lincoln & Guba, 1985), or as post-positivism (Hatch & Cuncliffe, 2006), is based on the premise that research involves constructing knowledge. This paradigm is concerned with the way humans, as social beings, interrelate and interact in society (Crotty, 1998; Denzin & Lincoln, 1998).

The social construction of reality is crucial to interpretivism. In contrast to positivists, interpretivists believe that what people know and believe to be true about the world is constructed as people interact with one another over time and in different social settings (LeCompte & Schensul, 1999). A key tenet of this paradigm is that scientific knowledge cannot be separated from its human context (Crotty, 1998). Meanings are constructed, so interpretations of what the theory means are just as important in judging its truth as the empirical observations on which they are based (Crotty, 1998). Any shared constructs and meanings are situated in, or affected by politics, society, culture, economy, ethnicity, age, gender and other contextual features of those who espouse them (Creswell, 2007, 2009; LeCompte & Schensul, 1999). These features influence how people think, believe and present themselves; interpretivists therefore concentrate on finding these local meanings by trying as much as possible to capture the complex environments and surroundings in which people live and act. This makes interpretive research inherently participatory, for meanings can only be created through these social interactions. Researchers in this tradition therefore must participate in the lives and environments of those being researched, observing the social dialogues and interactions as they unfold in their normal environments and surrounds

(LeCompte & Schensul, 1999). Moreover, realistic constructs and ideas can only be extracted and refined from the interactions of all who are involved, both the researchers and those being researched; data and findings are therefore created and recreated as the research proceeds.

Interpretivists see the human world as full of meaning, and any actions people take are based on shared meanings (Crotty, 1998). In order to understand society it is necessary for us to understand people's motives and interpretations of the world. The meanings people give to their circumstances are a way of explaining what they do. Inherent within this paradigm is the realisation that reality, as constructed in the minds of people, will differ from actor to actor. For this reason interpretivist researchers spend less time in verifying theories and more effort in understanding how different 'actors' make sense of the world and how they assign meanings to actions. Researchers in this tradition also believe that the reality as constructed is not the total truth; that it can be altered over time, through dialogue and actions, and that these alterations can lead to new views of reality and new ways of knowing and acting (LeCompte & Schensul, 1999). For interpretivists, knowledge is neither objective nor subjective but more inter-subjective, based on the shared meanings and understandings of the people being studied and the discipline of those undertaking the study (Warren & Karner, 2010).

Central to interpretivism is the understanding that the constructs and meanings of researchers and participants are equally weighted, as negotiated meaning cannot occur unless the researcher becomes a participant in the research process (Guba & Lincoln, 1994; LeCompte & Schensul, 1999). The consensus that results from the interactions between the different players in this research tradition can thus produce a deep sense of shared understanding of the issues being researched (Guba & Lincoln, 1994). The methods employed by constructivists reveal rich qualitative data about people's activities and their environments and contexts. In general, most qualitative studies are located within this paradigm. Exploratory case studies, 'general field studies', ethnography and some types of survey research are usually entrenched in this paradigm. In the RE literature, those published from an interpretive perspective are based on this paradigm.

3.1.1.3 Pragmatism

A third paradigm is pragmatism[6], which I considered at length in the early stages of this project, but which I discarded. In contrast to positivism and interpretivism, pragmatism holds the view that the research question that needs to be answered is more important than either the philosophical stance or the methods that support such a stance. The essence of pragmatism lies in the fact that it 'is the philosophy of common sense' (Shields, 1998, p. 197). As she posits:

> (pragmatism) uses purposeful human inquiry as a focal point. Inquiry is viewed as a continuing process which acknowledges the qualitative nature of human experience as problematic situations emerge and are recognised. Recognition involves the doubt associated with questioning the existing belief systems. Doubt is resolved through critical reasoning and ultimately tested in action. It is the philosophy of common sense, because actions are assessed in light of practical consequences (p. 197).

For pragmatists, knowledge claims arise out of actions, situations and consequences (Creswell, 2009; Shalin, 1986; Shields, 1998). The value of any knowledge that is generated through this depends on the methods by which it is obtained, rather than one's view of whether truth and reality are discovered or constructed (Easterbrook, Singer, Storey, & Damian, 2008). Those involved in this tradition of research assume that the paradigm attributes are logically independent and can be mixed and matched to achieve the most effective combination for the research question (Sandelowski, 2000). Hence, paradigmatic considerations regarding the nature of truth and knowledge are secondary.

Pragmatism is more flexible than positivism and constructionism because those researching in this tradition believe that they should be free to use whatever methods they can to shed light on the research problem (Creswell, 2009; Easterbrook et al., 2008). For this reason, they may use a range of methods, or mixed methods, to conduct their research. Pragmatists generally do not ascribe to the notion of compatibility in research frameworks; what they do realise is that there is some level of compatibility at the methods stage. In fact, the main criticism of pragmatism as a philosophical stance is that it does not align itself to a suitable methodological framework (Shields, 1998), and this may be one reason it does not feature

[6] Authors such as Crotty (1998) do not necessary see pragmatism as a paradigm, however, other such as Creswell (2009), Shalin (1986) and Shields (1998) do so, and I am more inclined to follow this line of thinking.

more prominently in academic research. I believe there is much scope for this tradition to be used more in health and safety research because it allows for obtaining more rich research data through triangulation. This point will be discussed in Section 3.4.5, data triangulation.

Given that the purpose of this study was to gain an understanding of whether SWMS enhance or impede RE, it then follows that interpretivism provides a suitable philosophical base for unfolding this understanding. According to the PRDD model, different players or 'actors' in an organisation will interpret SWMS differently, based on what they means to them, and what they use them for. Moreover, in making these meaning clear, the model also suggests the actors rely on a number of process, as well as interactions with each other and with different players and levels, in making sense of what things, such as SWMS, are about in the context of their different positions and responsibilities. Gaining an insight into these different interactions and constructions will reveal rich data about how SWMS are construed and used. Moreover, exposing the types of gaps that exist in the system, and understanding the extent to which they are narrowed to reveal whether the system is resilient or brittle means participating and entering the life of the organisation.

3.1.2 EPISTEMOLOGY

Epistemology involves the study of knowledge and justified belief; in particular, how knowledge is created and disseminated in different disciplines (Matthias, 2010). While research paradigms provide a general direction and set the boundaries and parameters for any research, epistemology sets the path for understanding and explaining how we know what we know (Crotty, 1998). Citing Hamlyn (1995), Crotty posits that 'epistemology deals with the nature of knowledge, its possibility, scope and general basis' (Crotty, 1998, p. 8). Hatch and Cuncliffe (2006) surmise that epistemology is about knowing how we know, how this knowledge is generated, the criteria by which we discriminate between good and bad knowledge, and the manner in which reality should be represented and described. In essence, it provides a basis of one's philosophical stance on research and helps in deciding what types of knowledge are possible and how we can ensure that the knowledge derived from the research process is both adequate and legitimate. Within the broad social sciences disciplines there are a range of epistemologies; Crotty (1998) suggests positivism, constructionism, critical inquiry, feminism and postmodernism to be the most common.

3.1.2.1 Constructionism

This study adopts the epistemological underpinning of constructionism, a philosophical stance that posits that 'all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context' (Crotty, 1998, p. 42). For constructionists, meanings and reality are not discovered; rather, they are constructed. As an epistemology, constructionism is situated within the interpretivist paradigm.

There are three key assumptions inherent in this epistemology. The first assumption underlying symbolic interactionism is that people construct meaning by engaging with the world they are interpreting (Creswell, 2007, 2009; Crotty, 1998). This world will differ for different people. For those in management, or the 'blunt end', this world can include contractors, suppliers, industry peers and advisors, and directives or broad organisational policies and objectives set by managers that are more senior. For supervisors this can include regulators, auditors, their colleagues and their subordinates. For workers at the 'sharp end', this normally includes their immediate supervisors and colleagues, the materials and resources they use to carry out their work and the environment and conditions in which they work.

The second assumption is that people engaging with their world make sense of it based on their historical and social perspectives (Creswell, 2007, 2009; Crotty, 1998). Any of the three groups discussed above will have developed and refined their understanding based on their experiences of the past, and the stance taken by their peers and their supervisors. This line of thinking can also be extended to how people at different levels will react to rules and procedures, including SWMS, based on their previous encounters. If historically an organisation's stance has been that SWMS are to be used as a set of guidelines for safe work practices for a narrow range of tasks or activities, and this is constantly reinforced, it is more likely that both the supervisors implementing them and the workers who are using them will see it in that light as well. On the other hand, if an organisation takes a laissez-faire attitude to SWMS and this is reinforced by supervisors, a similar stance may also be taken by workers at the sharp end of risk.

The third assumption is around how meanings are created; it arises in and out of the social interactions between people (Creswell, 2007, 2009; Crotty, 1998). In organisations, these interactions can occur on a number of different levels, on different occasions and for different purposes. Managers, for example, may be more used to interacting with front-line regulators, and their understandings of SWMS may be based on these interactions. This may also be the case with supervisors, but their understandings may also be derived from their interactions with safety personnel and with the employees themselves. Similarly, workers and plant operators may derive most of their meanings from those who they interact with. For health and safety representatives this may be with front-line regulators, their peers in the industry (especially if they are union-elected representatives), or from the managers and/or supervisors only, if this is how they predominantly learn. For other workers and operators, this may mostly include their co-workers or immediate supervisors. In the case of apprentices, this could include their colleagues, their co-workers and their teachers.

What is perhaps central to constructionism is that people may construct meanings in different ways, even in relation to same thing, a point that is made by Crotty (1998). This suggests that in exploring the dialectic between the prescription and practice of SWMS, it is possible that different managers may hold different views regarding what SWMS are about and what they are meant to achieve. Similarly, different supervisors and workers further down the chain may also have a different understanding of a SWMS, even if it is for the one activity.

3.1.3 THEORETICAL FRAMEWORK

A theoretical framework, according to Crotty (1998), is about 'the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria' (p. 3). It represents the structure, scaffolding and framework of one's study, the structure coming from the researcher's disciplinary orientation and the relevant literature, from which a case is built for the importance of the study through a presentation and critique of the concepts, terms, definitions, models and theories synthesised from the literature (Rocco & Plakhotnik, 2009). Employing a suitable theoretical framework involves not only presenting a specific theory, but also the empirical and conceptual work about that particular theory (Rocco & Plakhotnik, 2009).

One theoretical framework commonly used for constructing knowledge according to epistemology of constructionism involves symbolic interactionism (SI), and this is discussed next.

3.1.3.1 SI

The theoretical perspective that was used to inform this study is SI, something that is consistent with interpretivists' tradition of research. This perspective, closely linked with the works of Max Weber, George Mead, John Dewey, William James, Charles Pierce, William Thomas and Blumer, directs researchers to consider symbols and details of everyday life, the meanings of these symbols, and how people interact with each other (Charon, 2010). As this author points out, 'to understand human action, we must focus on social interaction, human thinking, definition of the situation, the present, and the active nature of the human being' (Charon, 2010, p. 29). Hence, in seeking to understand how SWMS are prescribed, SI requires that researchers focus on the social interactions and thinking of those who are involved in the prescriptions, and the context in which that thinking takes place. Similarly, in seeking to understand what SWMS practice is about, SI requires researchers to focus on the social interactions and the thinking of those who are involved in the practice SWMS.

There are three central assumptions inherent in SI. The first is that 'humans act towards things on the basis of the meanings that the things have for them' (Blumer, 1986, p. 2). This suggests that with respect to things such as SWMS, managers, supervisors and workers will act on them based on what they mean to them. For some a SWMS could mean that it is a procedure that needs to be followed to the letter, for others it may be a form for recording things that need to be considered and discussed, while for others it could be a process for checking whether things have been completed as expected.

The second assumption is that 'the meanings of such things are derived from, or arises out of, the social interaction that one has with one's fellows' (Blumer, 1986, p. 2). So managers, supervisors and workers will derive their meaning of SWMS based on their interactions with others; this could occur during at any of a number of stages, such as the formulation, deployment and (any) revisions of the SWMS. The opportunities for these interactions may differ from person to person. Schein (2003) suggests that these represent different occupational cultures, with people learning largely from whom they interact with. He argues that engineers and professionals learn from participating in professional and industrial seminars, conferences and the like; managers learn from and through their social networks both within and outside the organisations, while front-line technicians and workers learn from working with each other (Schein, 2003). What this clearly suggests is that the meanings attributed to SWMS may differ from one actor to the next, and even between actors playing similar roles, depending on where they largely draw their learning from.

The third assumption is that 'meanings are handled and modified through an interpretive process used by the person in dealing with the things he encounters' (Blumer, 1986, p. 2). According to the PRDD model, there are at least four points this could occur when SWMS are being prescribed. One is at the level of interpretation; it is here that people responsible for establishing policy and procedures for the organisation establish what a SWMS means in terms of management of safety. In order to do this they may seek to rationalise the meaning, which is the second point. Should the prescribed meaning be challenged in some way, there is a third point of reflection on practice; this may lead to either maintenance of the same stance or a revised understanding, which is then formally prescribed.

In a similar manner, what a prescribed SWMS means for a specific activity can be understood and explained through re-enactment, assimilation and reinforcement of practice in the repetitions cycle, or a RIA in the distinctions cycle where a similar activity is undertaken in a different context. Finally, when there is no prescribed SWMS, the descriptions cycle provides an opportunity for those engaged with the task to reflect on the actions they have taken and to formalise that thinking so that it becomes part of the accepted way of doing things on the next job.

According to this theoretical perspective, interaction among social actors is mediated by symbols and meanings that are socially constructed and manipulated through interpretation. Symbols are social objects that have meanings, are used to represent and communicate, and are intentionally used (Charon, 2010). They are meaningful because people are able to describe them, understand them and apply them (Charon, 2010). In representing something, symbols stand for, or refer to, something (Charon, 2010). Symbols enable us to share our understanding, telling others about what we think, know, intend and feel; therefore they are 'intentional acts of communication' (Charon, 2010, p. 49). There are many types of symbols, including words, actions, language, and physical objects. According to Hollnagel (2008b), rules and procedures act as a symbolic barrier system for preventing accidents. These types of barriers work indirectly through their meanings, and hence require an act of interpretation by someone (Hollnagel, 2008c). In doing so these symbolic barriers act in different ways. For example, instructions, procedures and dialogue may be used to regulate action; similarly, work permits and work orders allow or authorise the performance of an activity, or restrict the way in which it needs to be done (Hollnagel, 2008c).

The discussion so far has attempted to locate this research within a suitable philosophical orientation; in doing so the traditions of positivism and interpretivism have been considered.

I have argued that Interpretivism is an appropriate paradigm that can be used to examine the dialectic between prescription and practice of SWMS. I have also argued that there are a number of assumptions that are inherent in social constructionism and SI, so these epistemological and theoretical frameworks are well suited to examining the dialectic between the prescription and practice of SWMS. The meanings that people in different roles assign to SWMS and the actions they take (or do not take) from them is a result of a multifaceted net of social interactions that they have with others in the immediate and wider organisational setting. It is therefore essential to access these meanings from the different actors involved with SWMS. As Crotty (1998), citing Psathas (1973), suggests:

> 'Methodologically, the implication of the symbolic interactionist perspective is that the actor's view of actions, objects and society has to be studied seriously. The situation must be seen as the actor sees it, the meanings of objects and acts must be determined in terms of the actor's meanings, and the organisation of a course of action must be understood as the actor organises it' (p. 75).

What this also alludes to is that those who intend to use SI as the theoretical framework for their inquiry need to take the viewpoint of those being studied (Crotty, 1998). Charon argues this very point when suggesting that this was the most central consideration for those undertaking investigations in this tradition, stating 'the central principle of SI is that we can understand what is going on only of we understand what the actors themselves believe about their world' (Charon, 2010, p. 187). This understanding of the actors' points of view is the very tenet of SI:

> 'The actor lives in and knows his or her world. It is imperative to understand what the actors know, see what they see, and understand what they understand. We must understand their vocabulary, their ways of looking, and their sense of what is important. What the researcher must do is interact with the actors, observe and partake in their activities, conduct formal and informal interviews, and try to reconstruct their reality. Always, it is imperative to understand from their point of view what it was that influenced them to act as they did' (Charon, 2010, p. 187).

So SI, as a theoretical perspective, is consistent with Interpretivism and constructionism since all deal with the understanding of human endeavours, of social life and understanding how meaning and interaction within and among them influence people's practices in specified contexts. In Section 4.4.2, I discuss how this perspective can be used to analyse and interpret data.

The use of SI is not new in health and safety research. There are a number of notable studies that have utilised these approaches. For example, in his study of risk awareness and safety culture, Borys (2009) used this in an ethnographic study. He also used this approach in a recent study of SWMS (Borys, 2012), while Legget (2009) has also utilised SI for developing an understanding of how safety is managed in small construction businesses in Victoria. In a more recent study, Ayers (2011) used this approach to examine maturity of organisational cultures in Victorian construction organisations.

3.2 METHODOLOGY

The next step is to consider a broad methodology that can be used to collect, analyse and interpret the data that is consistent with interpretivism, constructionism, and SI. In the following section, I discuss the key principles of SI in relation to what they mean for investigations, and use this to make a case for a qualitative approach being more suited to developing an understanding of the dialectic between the prescription and practice of SWMS.

3.2.1 INVESTIGATIONS IN SI

According to Charon (2010), there are at least four important principles that symbolic interactionist investigators need to follow. The first is that developing an understanding of what is happening involves understanding of what the actors themselves believe is happening (Charon, 2010). As he posits:

> 'The actor lives and knows his or her world. It is imperative to understand what the actors know, see what they see, and understand what they understand. We must understand their vocabulary, their ways of looking, and their sense of what is important. What the researcher must do is interact with the actors, observe and partake in their activities, conduct formal and informal interviews, and try to reconstruct their reality' (Charon, 2010, p. 187).

The above highlights the importance of gaining a deep insight into how the different actors think, feel and act, a view that is further supported by Blumer (1986):

> '(the) contention that people act on the basis of meaning of their object has profound methodological implications. It signified immediately that if the scholar wishes to understand the action of people, it is necessary to see their objects as they see them. Failure to see their objects as they see them, or a substitution of his [or her] meaning of the objects for their meanings, is the gravest kind of error…' (p. 5–51).

Seeing reality from the actors' point of view is also about reality from the actors' perspectives, hence researchers need to see the socially constructed reality of what the actors see, rather than from their scholarly point of view only.

The second principle is that data needs to be gathered by observing people in real situations (Charon, 2010), hence research should thus describe people in their real settings, how they work, where they work, whom they interact with and the context of the interactions, not simulations of these. This involves more than just watching how people work in their real settings. As Charon (2010), citing Schwarz and Jacobs (1979), posits, observing and interviewing participants are the two most commonly employed techniques for understanding the perspective of actors in groups. Similarly, personal accounts and life histories attempt to capture the perspective of individual actors; while analysing contents in written materials and audio and visual tapes 'aim at understanding perspectives and action without direct involvement with the actors themselves' (Charon, 2010, p. 187). A symbolic interactionist therefore observes real people doing actual work in their normal environments, interviews them individually or in groups, examines and analyses documents the actors may they use in their work. These, coupled with taped and video recordings forms part of a suite of approaches for collecting and analysing data under SI.

The third principle is critical of traditional social science using scientific methodology for studying human beings, and its definitions of important causal variables (Charon, 2010). The way in which humans are to be studied needs to be based on the nature of the empirical world being researched. The appropriate empirical techniques must take into account the central qualities of human behaviour, understand how humans define situations, how they act in the present by applying past experience and future plans and how they solve problems that confront them (Charon, 2010). As he posits, recognising 'past events alone do not *cause* present action without an active person defining the situation and directing the self in the present' (Charon, 2010, p. 188). Thus it seeks to understand how humans not only think, but also how they solve problems, take on roles, apply their past and look to the future (Charon, 2010). This principle suggests that it is not necessary to look at simple cause-and-effect variables only, but to obtain a much deeper insight into how people behave in different contexts, including how they learn and apply lessons from the past to their current ways of working and the strategies they use to overcome difficulties. In essence, this principle reinforces the importance of understanding 'work as performed'.

The fourth principle involves a realisation that a careful description of human interaction is central (Charon, 2010). This means that a careful observation of action, a (careful description) of the important elements involved and a redefinition of these elements should be highlighted. This does not allude to understanding the cause-and-effect relationship between the variables (although this may exist), but to gaining a deep sense of the interplay between the central concept that is being investigated (Charon, 2010). Blumer (1986) identifies exploration and inspection as two specific methods of inquiry that are central to understanding reality. Exploration, according to Blumer, involves understanding what is going on through a detailed description of what is occurring in a particular social situation (1986). Inspection, a more detailed step, involves isolating important elements in the situation and describing this in relation to those concepts that are important for the study (Blumer, 1986). This detailed step involves describing the elements in a situation, then applying them to other situations where such interactions are likely to occur. Charon (2010), citing Stryker (1981), posits 'the procedure of inspection must be flexible, imaginative, creative and unroutinised' (p. 189). This principle suggests that it is important to describe observations in as much detail as possible, by considering how things are happening on the surface and also what this may mean in terms of the notions and concepts being studied. It is not necessary to describe the sequence in which the interactions are occurring, but to build a complete picture through one's imagination and creativity.

The fifth principle implies that there is a need to look beyond single, mechanical modes of causation to more process-type connections, linkages and relationships (Charon, 2010). Causes are, according to Charon, 'complex, multifaceted, developed over time rather than simple, singular, and isolated (2010, p. 189). This principle emphasises the need to see interactions as complex and multifaceted, and one cannot get away by looking at simple, linear relationships and connections, but suggests the need to look deeper.

The above discussion points a way forward in terms of a suitable research design for using SI as a theoretical framework. What is clear is that there is a need to collect different types of data directly from the field. Blumer captures the essence of this in terms of practice:

> 'It [SI] believes that this determination of problems, concepts, research techniques, and theoretical schemes should be done by the *direct* examination of the actual empirical social world rather than by working with a simulation of that world, or with a pre-set model of that world, or with a picture of that world derived from a few scattered observations of it, or with a picture of that world fashioned in advance to meet the dictates of some imported theoretical scheme or of some scheme of 'scientific' procedure, or with a picture of the world built up from a partial and untested accounts of that world. For SI, the nature of the empirical social world is to be discovered. To be dug out by a direct, careful, and probing examination of that world' (1986, p. 48).

The need to study people in their natural environments and settings is echoed by Charon:

> 'SI stands as an important criticism of using traditional scientific methods in social science. It is to always understand action from the perspective of those who act. It is to observe people in real situations. It is to broaden our understanding of cause to include definition of the situation in the present. It is to describe the elements of human interaction as well in order to understand the cause. It is to emphasise cause as highly complex and include a string of factors rather than the simple and single-faceted' (2010, p. 189).

The above discussion suggests that SI is more aligned to methods of inquiry conducted in natural settings, with particular attention being given to the nature of the interactions that occur in such settings. This points more towards qualitative, instead of quantitative, studies as an appropriate research design for collecting and analysing data. In the next section, I consider the essence of the qualitative tradition of research.

3.3 QUALITATIVE RESEARCH

Qualitative research is a form of inquiry that seeks to investigate social phenomena (Marshall & Rossman, 1999) 'in real world settings [where] the researcher does not attempt to manipulate the phenomenon of interest' (Patton, 2002, p. 39). It involves examining people's lives, experiences and behaviours, and the stories and meanings people assign to them (Denzin & Lincoln, 2000). Hence, it aims to study how people live, their experiences and behaviours in different contexts, their description of their lived experience and what it means to them. Seen another way, it involves 'any kind of research that produces findings not arrived at by statistical or other means of quantification', the aim of which is to 'discover, describe, or understand the meanings ascribed to phenomena by the perceptions and experiences of individuals' (Sechrest, Stewart, Stickle, & Sidani, 1996, pp. Ch 10-14).

The absence of quantification is not the only thing that distinguishes quantitative and qualitative research; it runs deeper than numbers and quantities. In contrast to quantitative studies, which seek to answer 'how much' and 'what' type of research questions, qualitative research is aimed at answering 'how' and 'why' type questions (Guba & Lincoln, 1994; Kuper, Reeves, & Levinson, 2008).

A qualitative research design is consistent with a constructionist worldview that suggests that there is no objective or subjective reality and acknowledges that multiple realities exist as they are created by individuals through their experience and interactions with others. Qualitative research is designed to explore and understand these realities as they are reported by individuals. As an approach to research it contributes to the development of new knowledge in a number of different ways, for example, by (i) enabling researchers to gain a better understanding of complex concepts and social processes, (ii) investigating how organisations, groups and individuals interpret and make sense of their experiences and (iii) eliciting contextual data for improving the authenticity, validity and reliability of data and the rigour of the data collection method itself.

There are many genres that are common to qualitative research and different authors have described these in different terms. For example, Atkinson, Delamont and Hammersley (1988) suggest there are at least seven different approaches to this research tradition, including anthropology, democratic evaluation, ethnomethodology, feminism, Neo-Marxist ethnography, sociolinguistics and SI. Others such as Denzin and Lincoln (2000, 2005) expand this into eight different approaches: action and applied research, case studies, clinical research, ethnography, grounded theory, historical method, life history and *testimonio* and phenomenology, while Australian authors such as Liamputtong and Ezzy (2005) suggest there are in-depth interviews, focus groups, unobtrusive methods, narrative analysis and life history, memory-work, ethnography and participatory action research. On the other hand, Creswell (2007, 2009) consolidates these into five different approaches: biography, case study, ethnography, grounded theory and phenomenology. The classifications suggested by Creswell (2007, 2009) and Denzin and Lincoln (2000, 2005) include case studies; in the next section this is discussed as the methodology of choice for this research.

3.3.1 CASE STUDY

A case study is a strategy of inquiry that involves an in-depth exploration of a program, event, activity or process, or one or more individuals (Creswell, 2007, 2009; Kuper et al., 2008; Stake, 1994, 2000). The case(s) are bound by time and activity, and researcher(s) collect detailed information over a sustained period of time using a variety of data collection procedures (Creswell, 2007, 2009; Stake, 1994, 1995, 2000). According to Yin (2003), it is 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident' (2003, p. 13).

Seen from the perspective of rules and/or procedures, SWMS are a contemporary phenomenon; however, there is limited understanding about how they is interpreted by managers, supervisors and workers, and how this interpretation leads to safe work practices. Thus the boundary between the notion of what SWMS constitute and what they are expected to lead to as an outcome for the different actors is not clear. As a strategy of inquiry, case studies enable researchers to collect data through multiple sources and to develop an in-depth description and analysis (Creswell, 2007; Stake, 1995). Thus, it is a comprehensive research strategy that can be useful in gaining a deeper understanding of how SWMS are interpreted and applied in the construction environment.

There are different types, or taxonomies, of case studies. Stake (1994, 1995) suggests these are intrinsic, instrumental or collective. An intrinsic case study is one where the case is of primary importance, rather than the phenomena (Stake, 1994, 1995). An instrumental case study is one is that is used to provide insight into an issue or to refine a theory. Here, 'the case is of secondary interest; it plays a supporting role, facilitating our understanding of something else' (Stake, 1994, p. 237). In a collective case study researchers study a number of cases to enquire into the phenomena, population or general condition. There is less interest in a particular case; individual cases in a group are chosen because 'it is believed that understanding them will lead to better understanding, perhaps better theorising, about a still larger collection of cases' (Stake, 1994, p. 237).

Case studies have been previously used in health and safety, construction safety and RE research in a range of industries. Because it has been well established as a method of research, it can be usefully employed for examining the whether SWMS enhance or hinder RE as a health and safety management strategy.

While it as an established methodology, there are a number of criticisms of case studies; Flyvbjerg (2006) condenses these to five common misunderstandings. These misunderstandings centre around (i) the value of theoretical and practical knowledge, (ii) the inability to generalise from a single case, (iii) usefulness in generating hypotheses as opposed to hypothesis testing and building of theory, (iv) bias towards verification and (v) difficulty of summarising specific case studies (Flyvbjerg, 2006). Flyvbjerg argues the use of a greater number of case studies would be a useful way forward. In other words, Flyvbjerg argues for collective case studies as suggested by Stake (1994, 1995). This particular research involves a collective case study of SWMS in three construction organisations.

3.4 DATA COLLECTION IN QUALITATIVE RESEARCH

The main outcome of qualitative research is the generation of rich, in-depth accounts of individuals and groups by talking with them, watching their behaviours, analysing the symbols they interact through and taking into account the range of contexts in which these occur (Kuper et al., 2008). In Section 3.3.1, it has been argued that SI creates an opportunity for an array of methods to be used for collecting data. These include observations, interviews, audio and video recordings and documents, all of which are consistent with qualitative research. These views are also shared by authors such as Kuper: 'qualitative researchers primarily gather data from interviews (semi-structured or unstructured), focus groups, observations, or documents and other written artefacts' (Kuper et al., 2008, p. 405). The rest of this section discusses the essence of these methods, and concludes with how triangulation can be used to enhance the quality of research.

3.4.1 INTERVIEWS

Interviews are one of the most commonly accepted methods of collecting data in qualitative research. Interviews, according to Kvale (1996) involves 'conversations where the outcome is a co-production of the interviewer and the subject' (p. xvii). The conversation is special because the interviewer questions respondents on a topic that interests the interviewer, and which may have some relevance for the interviewee (Warren & Karner, 2010). In doing so the researcher is attempting to understand the world from the participant's point of view, unfold the meaning of this experience and uncover their lives in some form (Kvale, 1996; Warren & Karner, 2010). They are in-depth (or intensive) in nature, have a purpose and structure, and go beyond the spontaneous exchange of views that are shared in everyday conversations (Kvale, 1996). As the author points out, '…interview is a construction site of knowledge' (Kvale, 1996, p. 42). The main aim behind interviewing is to elicit the views and responses of a range of actors to indicate the meanings they give to aspects that are of interest to the researcher. As Stake (2010) suggests, two main purposes of this approach in qualitative research are (i) to obtain exclusive information, perceptions or thinking held by the person being interviewed and (ii) find out about the phenomena that the researchers may not be able to observe themselves. What sets interviews apart from other normal conversations commonly encountered in field research are their formal structuring. First, this includes the development of a specific set of questions that are asked of respondents (Warren & Karner, 2010). Two, this involves the selection of respondents (Warren & Karner, 2010). Three, it involves audio or video taping of the interview (Warren & Karner, 2010).

Interviews can be conducted with an individual or as a focus group. A focus group, according to Morgan (1996), 'is a research technique that collects data through group interaction on a topic determined by the researcher' (p. 130). As Farnsworth and Boon (2010), citing Kitzinger (1994), point out, it is particularly useful in 'connecting with difficult-to-reach individuals: not only does safety in numbers make some people more likely to consent to participate in the research…but being with other people who share similar experiences encourages participants to express, clarify or even develop particular perspectives' (Farnsworth & Boon, 2010, p. 609). In addition, this approach also assists in accessing a larger number of actors in a shorter time frame (Warren & Karner, 2010). Good focus groups promote a comfortable atmosphere of exposé in which people can share their attitudes, experiences, and ideas with respect to the topic being studied.

Focus groups also provide an avenue for discussions and interactions between the interviewees (Morgan, 1996). Such discussions and interactions, according to the author, are an important because the participants are querying each other and explaining themselves to each other, thus providing valuable data on both consensus and diversity in the topic of interest (Morgan, 1996). Hence they provide a deep understanding of how and why the actors' views differ, the strengths of the attitudes, beliefs and opinions held, and the factors that play a role in the different perspectives (Willis, Green, Daly, Williamson, &

Bandyopadhyay, 2009). Thus focus groups can provide a rich source of data when health and safety researchers and practitioners want to better understand how SWMS are enacted and interpreted in organisational settings.

There are a number of strengths in collecting data through interviews. Creswell (2007, 2009) has identified at least three. First, they are very useful when participants cannot be directly observed (Creswell, 2007, 2009). Second, historical and more contextual information can be provided by the participants themselves (Creswell, 2007, 2009). Third, they enable the researcher to exert a level of control over the lines of questioning and any discussions that take place (Creswell, 2007, 2009). Marshall and Rossman (1999) suggest there are other strengths with interviews. For example, they enable direct interaction with participants; they are useful in uncovering participants' perspectives; they facilitates data collection in natural settings and enable immediate follow-up for clarification; they are useful in describing complex interactions; they provide information on context and facilitate analysis, checks for validity and assist in the triangulation of data.

Interviews also have a number of limitations. One, the researcher has less control over the data in focus groups when compared to one-on-one interviews (Creswell, 2007, 2009). The nature of focus groups is such that they are often more open-ended and cannot be entirely predetermined. So it becomes important to consider the voice of each participant in a focus group. Two, workers may convey guarded responses; hence they may be less authentic. As Creswell (2009) posits, interviews 'provides indirect information filtered through the views of the interviewees' (p. 179). In focus groups that are made up of both supervisors and their subordinates there are power differentials, and these could influence what people say. Three, people may say what they believe they believe the researcher wants to hear. Creswell expresses this very clearly, arguing that a 'researcher's presence may bias response' (2009, p. 179). Four, people who are interviewed may not be able to articulate what they want to say very well (Creswell, 2009). In the construction industry this could be an issue, because a large component of the workforce are unskilled, with many having low levels of literacy (Bates & Holton III, 2004). They therefore may not express themselves well, resulting in long conversations and not revealing much in terms of actual substance of research.

Other limitations of interviews and focus group are that questions being asked by researchers can be misinterpreted due to cultural differences, they may be difficult to replicate, and the approach is very dependent on the informants being honest and open (Marshall & Rossman, 1999).

3.4.2 DOCUMENTS

According to Warren and Kraner (2010), documents of many kinds can be used for research. These documents can include those published by local industry associations, state regulators, and national departments. Common types of documents that are used in health and safety include codes of practice issued by SWA or WorkSafe Victoria and industry associations associated with the housing and construction sector. Templates of work procedures and SWMS and samples of these are also commonly found on a range of websites. Even specific work procedures, job safety analyses and SWMS are abundant and freely available for downloading and printing from these websites.

Knowledge regarding the history and context surrounding a particular setting also comes, at least in part, from documents (Marshall & Rossman, 1999). Such data can be sourced from annual reports, websites and other archival and historical records maintained by organisations. Other common sources of data include field notes of observations and interviews maintained by researchers.

There are a number of strengths in using documents for research. Data can be collected in natural settings; the document that is available includes information on the context; they facilitate analysis, checks for validity and triangulation of data; they are easy to work with for analysis and can expand access to distant participants (Marshall & Rossman, 1999). This is particularly useful in construction, where actual construction work is undertaken at a distance from the head offices.

There are also a number of limitations in using documents for research. First, they may be protected and not generally available to the public (Creswell, 2009). Second, they may be incomplete or out-dated (Creswell, 2009). Third, they may not be authentic or accurate (Creswell, 2009). Fourth, they requires the research to be extended to places that may be difficult to access (Creswell, 2009). Fifth, they require transcribing and optical scanning (Creswell, 2009) or photocopying for computer entry. The latter can be particularly difficult for construction activities that are performed by subcontractors. They may have documents on site but facilities for photocopying may not exist. Moreover, even when documents are available, contractors may be reluctant to part with them for a day to be photocopied or scanned, for fear of not having the document with them should an incident occur or that they may not be returned. Moreover, the availability of documents may lead a researcher to fixate on details, and they may be difficult to replicate (Marshall & Rossman, 1999).

3.4.3 OBSERVATIONS

According to Ezzy (2002), 'describing the social processes that make life meaningful is the heart of good qualitative research' (2002, p. xii). This means the researcher has to be part of the research setting. Charmaz (2004) takes this even further, arguing that gaining 'a deep understanding of the studied life means entering it' (p. 890), while Ezzy (2002) suggests that 'Qualitative observation…is best done when the observer becomes part of the dance. Conducting qualitative research is about participating in other people's lives and writing about that participation' (2002, p. xii). This highlights the importance of engaging actively with those being studied. As Marshall and Rossman (1999) contend, this requires systematically noting and recording events, behaviours and artefacts or objects in the social setting that has been chosen for the investigation. Hence, observations are a fundamental and extremely important method in all qualitative studies. These observations can occur along a continuum, 'from a highly structured, detailed notation of behaviour structured by checklists to a more holistic description of events and behaviour' (Marshall & Rossman, 1999, p. 98).

There are a number of different roles that a researcher can play in field observation. McCall and Simmons (1969) suggest one can become complete participants, participant–observer, observer–participant and complete observer. The extent to which the researchers take on these roles depends on a number of things, such as the degree to which they are interested in participating and/or observing, how much they intend to reveal, and how deep they wish to focus (Marshall & Rossman, 1999). The full participant, for example, goes about ordinary life in a role or set of roles constructed in the setting. The full observer, on the other hand, does not engage at all in the social interactions. The authors posit that some sort of direct and immediate participation in the research environment usually becomes important to building and sustaining relationships. Helping out with small chores (or large ones), learning more about a particular activity (thus entering into that activity), or engaging in the daily activities creates reciprocity, and is usually informative yet remain informal (Marshall & Rossman, 1999).

Similar to other methods of collecting data, observations have a number of limitations, the main one being the 'potential lack of objectivity since the researcher is not necessarily an independent observer but a participant, and the phenomenon being observed is the subject of research' (Iacono, Brown, & Holtham, 2009, p. 39). Another is that the data may be affected by the presence of the researcher (Marshall & Rossman, 2009); the informants may be suspicious of the researcher and reluctant to participate or eager to please, injecting their own impressions and biases (Iacono et al., 2009). A third includes the influence that arises from the relationship developed between the researcher and the informants (Iacono et al., 2009). A fourth is that observation is highly dependent on the openness and honesty of the participant; and the fifth that it is highly dependent upon the interpersonal skills of the researcher (Marhshall & Rossman, 1999).

3.4.4 TRIANGULATION

To overcome these limitations, qualitative researchers such as Denzin (1978, 1989) and Jick (1979) recommend triangulation, a strategy that involves 'the combination of methodologies in the study of the same phenomenon' (Jick, 1979, p. 602). As Denzin (1989) posits, 'by combining multiple observers, theories, methods, and data sources, [researchers] can hope to overcome the intrinsic bias that comes from single-method, single-observer, and single-theory studies' (p.307). Over the years triangulation has evolved to include not only multiple data collection and analysis methods, but also multiple sources of data (Patton, 2002). The main purpose of triangulation, according to Patton (2002), is not to achieve the same result but to test for consistency of the results collected and analysed in qualitative studies. Triangulation has a number of advantages, such as (i) allowing the researcher to be more confident of their results, (ii) inspiring the development of more creative ways of collecting data and (iii) generation of thicker and richer data (Jick, 1979).

3.5 REFLECTIONS

As a newcomer and a novice to social science and qualitative research, I was amazed at the large number of texts that are written on research methodology. I was perplexed, if not confused, by the many different levels and terminologies, such as research paradigms, theoretical frameworks, worldviews, traditions of research, even methods and methodologies. As I found out, many of these terminologies are used interchangeably by different authors, a point that has been raised by authors such as Rocco and Plakhotnik (2009). I have chosen to separate a research paradigm and epistemology as two different concepts, as I view research paradigms as the overall philosophical context that guides the way academic research is to be conducted.

In the early part of my candidature I was captured by the philosophical thinking of pragmatism; for me any knowledge is only useful if it has a practical benefit. Coming largely from a generalist health and safety practitioner background, I subscribe to this line of thinking. I believe theoretical orientations and philosophies do have an essential place in research, but strongly aligning to these means we may well fall short of reaching practitioners and users of knowledge, who usually stay well out of academic thinking and development. I think pragmatism still has a lot to offer to health and safety research, and it is for this reason I have included it as a point of reference, alongside positivism and interpretivism.

In choosing to use the theoretical framework of SI for this study, I have tried to follow a tradition that has been well established for undertaking health and safety research at the Victorian Institute of Occupational Safety and Health (VIOSH). I believe this framework sits well with the new view of safety as an emergent property of an organisational system, rather than something that is built in the system itself.

Case study is one of the many qualitative research genres that are increasingly being used in studying social life. It could be argued that ethnography could have been a much better approach to understanding how work is actually performed. I considered this approach at considerable length; however, the fragmented nature of the construction industry, the large number of subcontractors and the relatively short duration of many of the tasks in domestic and medium-density construction meant that accessing subcontractors and spending significant periods of times with them would prove to be challenging. I believe that triangulation of data collection approaches in case study provides for as robust a method as ethnography.

CHAPTER 4: RESEARCH DESIGN

4.0 INTRODUCTION

In this chapter, I discuss the research design, data collection methods and data analysis. In doing so I first introduce socio-technical systems to provide the context within which SWMS are located in a construction organisation. A brief discussion of multi-level case analysis as an approach for researching socio-technical systems then follows. I then outline the approach that was used for collecting and analysing the data collected across the multi-level system. Next, I discuss the approaches used for purposeful selection of research sites, how access to sites and key informants was negotiated and the steps that were taken to build rapport. Next, I briefly introduce the three construction sites and the three high-risk construction-related activities that inform this study. Third, I discuss the data collection strategy, and fourth, how the data was analysed is presented. Fifth, the strategies used for maintaining quality of research process are also covered, and the chapter concludes with some reflections on the methodology employed in this research.

4.1 ETHICS

Approval to conduct this study was obtained through the University's Human Research Ethics Committee (Appendix 1). The specific issues I considered and addressed at the planning stage included: (i) protecting participants from harm, (ii) obtaining informed consent and (iii) maintaining confidentiality and the privacy of informants (Pillay, 2013). However, other ethical issues challenged me across my research journey; in my reflections I touch on two that issues arising during recruitment and writing up. A final ethics report of my study is attached in Appendix 2.

4.2 RESEARCH DESIGN

This research is broadly aimed at developing an understanding of whether SWMS enhance or impede RE as a health and safety strategy in construction. According to new thinking about safety and accident prevention, safety is a dynamic property (Cook et al., 2004; Cook

& Rasmussen, 2005; Hollnagel & Woods, 2006) that emerges out of the interactions between different elements and subunits of a socio-technical system (Ale, Brighton, & Baram, 2006; Rasmussen & Svedung, 2000). This socio-technical system includes several levels, including government, regulators and associations, company, management, staff and work (Rasmussen, 1997; Rasmussen & Svedung, 2000). Each of these may play different roles in the system, and they may either influence, or be influenced by, the other levels of the system in question. Therefore, it is important to be aware of the broader socio-technical system of construction of which SWMS are a part of. This is done in the next section.

4.2.1 THE SOCIO-TECHNICAL SYSTEM OF CONSTRUCTION

In Victoria, SWMS form part a of broader socio-technical system that comprises at least six levels[7] (Pillay, Borys, & Else, 2012), illustrated in Figure 7. The first three levels are generally external to the organisation, while the next three are internal. The first level involves the government; the main agency involved here is SWA. This agency sets the broad health and safety policy based on the political aspirations and ambitions of the government of the day. Most recently, SWA developed and released the Model Work Health and Safety Act 2010, Model Work Health and Safety Regulations 2011, and a series of codes of practice to fulfil the agenda of 'harmonisation' of health and safety laws. The ABCC and the FSC discussed in Section 1.3 are also represented at this level.

The next level is the regulator that translates the government's aspirations into safety law and enforces this in industry. The agency responsible for this is WorkSafe Victoria, through the Occupational Health and Safety Act 2004 and the Occupational Health and Safety Regulations 2007. They also adopt the Model COPs issued by the SWA. It is at this level that the legal prescription of SWMS is established.

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7 Rasmussen (1999) suggests there is an additional level which he calls work, for the purpose of thesis I have integrated this into the workers level.

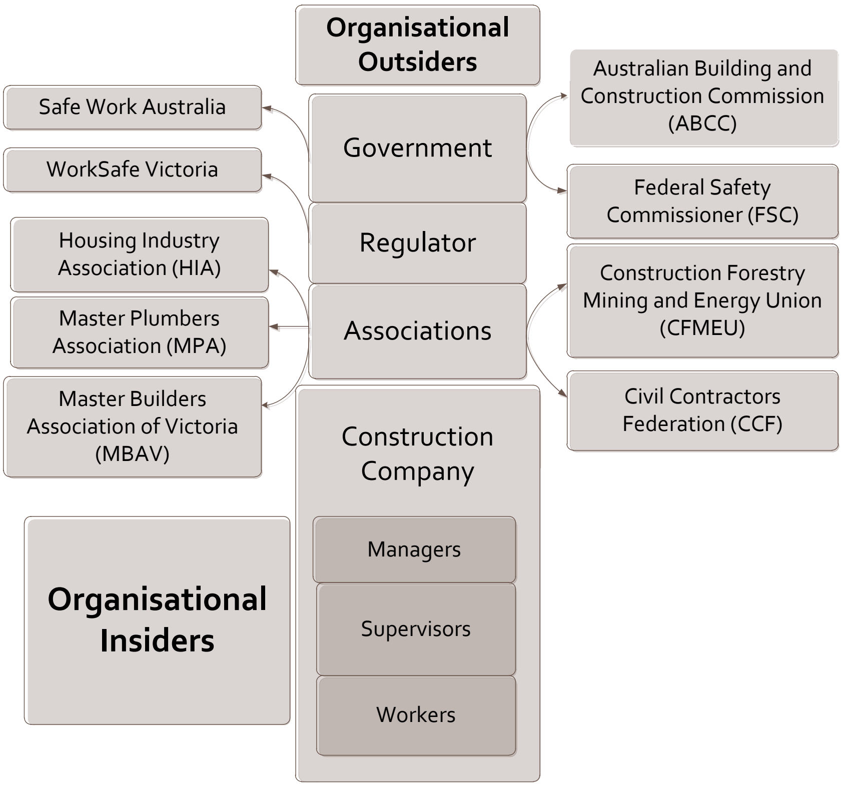

Figure 8: The Socio-Technical System of Construction Work

(Adapted from Rasmussen, 1997, Pillay et al., 2012)

The third level includes associations of employers and unions; such as the Housing Industry Association (HIA), Master Builders Association (MBA), Civil Contractors Federations (CCF), Master Plumbers Association (MPA). In addition, a number of different segments and interest groups may also be represented here, such as Australia's Largest Residential Builders (ALRB) and Volume Home Builders (VHB). The main union involved is the Construction, Forestry, Mining and Engineering Union (Construction Division) (CFMEU). Both types of associations provide consultancy and advisory services to assist their members make sense of the Acts, Regulations, and COPs. It is at this level that the legal prescriptions are translated into advisory documents that are then made available for use, including 'generic SWMS' that can be accessed and used by members.

The fourth level includes the company that undertakes the construction work, largely as principal contractors. They oversee development and construction, set broad policies and frameworks for works, operations and safety. It is at this level that senior managers or those at the 'blunt end of risk' translate the legal requirements into organisational policies, standards, and/or rules. In doing so, they may seek advice and assistance of the association to which they belong. In effect, it is at this level that the legal prescriptions of SWMS are translated into forms of organisation control documents.

The fifth level is represented by managers who are project and/or site managers, depending on how the company is structured. By and large, their job involves managing a portfolio of construction jobs; in doing so they generally work with a range of building supervisors who they supervise. These managers are generally responsible for establishing and meeting targets for production and safety, and selecting different subcontractors. They work hand-in-hand with OHS personnel such as managers, coordinators, and advisors in implementing broad-level organisational controls.

The sixth level is represented by the workers, comprised of a myriad of building and construction supervisors, subcontractors, tradesmen, apprentices and direct workers. They are generally responsible for engaging with subcontractors, inducting them on site, arranging for tools, equipment and resources and for general supervision of the subcontractors. At this level, the supervisors play two distinct roles. One of these is as a manager for either one specific contract or a number of construction projects; and it is here that they implement organisational policies, procedures and controls, including SWMS. The other is as an employee, where they themselves are expected to follow policies and procedures that have been laid down by their organisation or by the principal contractors. Thus, supervisors may play a role both in the prescription and in the practice of SWMS.

Each of these levels are subjected to pressures and stressors (such as changes in legislation, political climate, market conditions, management, competencies and technology); and because the levels are interconnected they are likely to affect the entire system (Leveson, 2004; Rasmussen, 1997; Rasmussen & Svedung, 2000; Wiig, 2008; Wiig & Aase, 2007). Hence, how SWMS are perceived, constructed, and acted upon at each of the different levels is expected to depend upon pressures and stressors exhibited by that part of the socio-technical construction system. Higher-level influences such as government policies and accreditation requirements, legislation by regulators and industry-level drivers can be mediated by the dynamics and responses not only from organisations but also from the smaller teams, individuals and groups that work within and across the organisation in order to perform work.

The above discussion suggests that gaining an understanding of SWMS requires one to explore the interactions between the different levels of this socio-technical system and to make explicit the interfaces of their normal work systems (Rasmussen, 1997; Rasmussen & Svedung, 2000). We need to understand the prescription of SWMS from government, regulator, associations, organisations and management. In a similar manner, we need to understand the practice of SWMS from the lower levels, including supervisors, workers, and the work context.

One approach that has been suggested to be useful entails multi-level analysis, which involves studying the vertical interactions between the different levels of socio-technical systems with reference to the hazards they are expected to control (Rasmussen, 1999; Rasmussen & Svedung, 2000). Multi-level research is a useful way of understanding organisational systems, and enables researchers to develop a deep insight into the realities of the complex nature of work in organisations (Hitt, Beamish, Jackson, & Mathieu, 2007; Klein & Kozlowski, 2000). A framework for conducting multi-level analysis has been proposed by Wiig (2008), which was used earlier to investigate learning from errors in healthcare (Wiig & Aase, 2007) and how regulatory practice affects procedures and routines involving patient safety (Wiig & Lindøe, 2009). This framework can therefore be usefully applied for exploring SWMS in the construction socio-technical system of work. The next section discusses the specific approach employed in this study.

4.3 MULTI-LEVEL CASE ANALYSIS

The application of multi-level case analysis employed in this research project comprised was achieved by (i) pre-entry and organisational selection, (ii) entry into the field, (iii) data collection, and (iv) data analysis.

4.3.1 PRE-ENTRY AND CASE SELECTION

According to Stake (1994), a case study is designed to 'optimise understanding of the case' (p. 236). Cases thus selected must be relevant to the phenomenon under investigation (Appleton, 2002). Stake (1994) argues for the need to select those cases that offer the greatest opportunity to learn from as the investigator endeavours to gain a deeper insight into the complexities of the cases involved. According to Patton (2002), this involves adopting purposive sampling techniques to gather information-rich cases. Devers and Frankel (2000) argue that such sampling is generally employed in qualitative research 'to enhance understandings of selected individuals or groups' experiences' (p. 264). This includes selecting information-rich data sources; i.e., individuals, groups, organisations or activities that provide the greatest insight into the research question. In this research the interest is in typical cases (Stake, 1994, 1995) that are also illustrative.

4.3.1.1 Purposeful Selection of Research Sites

First, the predominant industry organisations involved in the commercial, residential and civil construction sectors were targeted. These included the CCF, the Victorian Division of the HIA, the Master Builders Association of Victoria (MBAV), and the Victorian Construction Safety Alliance (VCSA). The websites of these organisations were searched; telephone and email contacts of persons responsible for health and safety were contacted by phone, followed up with an email that provided a summary of the project, key activities, tentative timeframes and resourcing needs. Initially one industry group, the VCSA, indicated an interest in the research. A one-hour meeting was held with a sub-committee of the VCSA in December 2010. However, similar to all industry groups initially contacted, they too declined to participate in the research[8].

The second strategy for selecting organisations involved going back to a number of commercial and residential construction companies, door-knocking and discussing the project with key health and safety personnel and inviting them to participate. This also included discussions at the UB for the possibility of using one of the construction projects as a possible research site. Eight companies were also door-knocked, visited and personally invited to participate in the research. While this approach generated a number of in-principle

[8] In accordance with the approval provided by the university's human research ethics committee, no reasons were sought regarding why organisations did not want to participate. However three of industry associations themselves provided that generally health and safety was a sensitive topic area of research for construction, there had been a recent saga involving a manager who had been caught spying on union workers under the guise of performance audits, and a third suggested there was a lot of uncertainty surrounding SWMS and the harmonisation process itself, while another suggested the activities of interviewing and observations were very resource-intensive and could not be facilitated at that particular point in time.

approvals, no organisations provided a written letter of approval[9]. At this stage, it was decided that a risk-managed approach was required, and an alternative plan of action for data collection was agreed upon. This included the possibility of an industry-wide quantitative questionnaire survey on SWMS, and the need for a totally different research design. This meant a totally different research design to the one originally planned for, and perhaps a different set of research questions altogether. For a period of time, this involved working on two different lines of planning.

A last attempt at selecting organisations involved going back to a network of colleagues I had previously worked[10], and seeking their assistance to gain some interest in the research from the housing industry. This strategy resulted in a higher degree of interest being shown from the VHB Safety Alliance, and two organisations in particular. Written approvals were finally obtained from these two organisations. Upon commencement of the data collection, written approvals were also obtained from one subcontractor working with one of the organisations[11]. As the data collection progressed, written approval was also negotiated with a commercial builder. Hence, these purposefully selected three organisations provided the research sites for this study.

4.3.1.2 Research Settings

The three organisations that acted as the key research sites included two domestic and one commercial builder, all of which operate as principal contractors[12]. Details of the three organisations are provided in Chapter 6.

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[9] Obtaining a formal written approval from organisations was a requirement placed on this research by the University of Ballarat Human Research Ethics Committee.

[10] This was the originally discussed as the key strategy for the selection of research sites. However, because of my previous role as an Inspector for health and safety, it was deemed that this approach might not meet approval of the university's human research ethics committee.

[11] While it was a preferred position to obtain a written approval from all contractors and subcontractors, it was agreed that, because of difficulties in getting such approvals from the larger commercial and residential builders, a written approval from the principal contractor, in conjunction with the voluntary nature of participation by key informants, would be adequate to progress the data collection

[12] In terms of Health and Safety legislation in Victoria

In addition to the above three organisations, three other organisations were also used to collect the data as part of the multi-level case study analysis. This included government, regulators and one association. Data for government was collected from SWA; the regulator's data was collected from WorkSafe Victoria[13], and industry data was obtained from one employer associations[14]. These avenues provided an information-rich source of data, and allowed for the triangulation of the data collected. A sample of documents obtained from the SWA website provided the key source of data for the governmental level of analysis[15]. Interviews with inspectors and senior inspectors and samples of documents maintained on the regulator's website provided the key sources of data for this research. A reconstructed interview and publicly available documents on the employer association's websites provided the key sources of data for the industry association level.

4.3.2 ENTRY INTO THE FIELD

According to Charmaz, gaining 'a deep understanding of studied life means entering it' (2004, p. 980). An important part of negotiating entry includes dealing with gatekeepers, 'someone with formal or informal authority to control access to a site' (Neuman, 2003, p. 372). These gatekeepers can either assist or hinder the progress of any research study, depending on their personal values, perceptions and interests, and their approach to the welfare of the people they manage (Reeves, 2010). It is therefore important that researchers build a good working relationship with gatekeepers. In some cases there will be a need to negotiate access with influential gatekeepers at multiple entry points (Atkinson & Hammersley, 1998; Feldman, Bell, & Berger, 2003; Marshall & Rossman, 1999; Wanat, 2008). Formal gatekeepers, according to Wanat (2008), are usually in positions of power and have the authority to grant official permission and access to specific entry points. Informal gatekeepers, on the other hand, usually protect the research settings and participants (Feldman et al., 2003; Wanat, 2008).

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[13] This is the regulatory arm of the Victorian WorkCover Authority (VWA).

[14] I was unable to obtain a written approval from either the employer or the employee associations, but a key informant was willing to discuss his experience regarding SWMS in the broader Victorian construction industry.

[15] Interviews were planned to be conducted with this level, however, this did not eventuate.

In negotiating access to gatekeepers I first had to convince those who were providing written approval and access down the line that I was able to enter construction sites and to work unsupervised. I therefore had to complete a Construction Industry Induction Training[16] course before I could talk with the gatekeepers. A copy of the White Card obtained is attached at Appendix 3.

For the domestic construction organisations, two levels of access were negotiated in this research. The first level involved obtaining a foothold into the organisations. This involved getting to know the health and safety personnel; namely, an Environmental Health and Safety manager and an OHS advisor, and obtaining their written approval. This was followed by introductions to building and construction managers and supervisors, who acted as the second level of gatekeepers and who assisted me to gain access to a range of work performed by subcontracted tradespeople.

In seeking access to the commercial site, access had to be negotiated through four different levels of gatekeepers. The first was through the Capital Projects Division team of the University. This group has been involved in the tendering and selection of a principal contractor for the construction project. The process involved signing a number of forms dealing with confidentiality before access to any documents and any persons involved at any stage of the construction could be obtained. I signed a four-page document associated with privacy and confidentiality and also completed a contractor induction program.

The second level of gatekeepers involved the project manager from the principal contractor, who provided written approval to undertake research on their site. Included in this approval were about 12 conditions associated with the entry and research. Some of these I renegotiated[17] at the site level with the site manager.

A third level of gatekeeping also had to be negotiated through a site manager based at the construction site, in conjunction with the site's union representative. Here I was informed that while I was free to speak with the different subcontracted tradespeople, approval from

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[16] Commonly known as a White Card, current safety legislation requires that this be obtained by those working in the building and construction industry no later than within three months of commencing work on a construction site. However, in Victoria, unions and employers have made it compulsory for all intending to work in the industry to be in the possession of such a card before they are actually allowed on a construction site.

[17] This included things such as times at which I could speak with the informants.

the union was required in order for me to speak with any of their members. I discussed with the union representative that I already had a written approval from the principal contractor to be on site, and that I had completed the 'white card training'. I was advised these did not necessarily mean access to the trades, and joining the union would be a better way. I was informed that the joining fee would be 'waived' to assist me in joining the union. I took this option and became a union member for three months. I also completed site-specific induction training for contractors and visitors to the site[18]. I was provided with a notebook, a series of stickers to go on my hard hat, as well as a series of other items designed to reflect that I was one of the 'boys' on the job.

A fourth level of gatekeepers came from the different trades; ranging from concreters, plumbers and machine operators. At this level, the supervisor from one of the trades checked that I had a copy of the white card with me, and that I was current with the site induction. The other two supervisors took it for granted that since I was from the university the principal contractor had granted me permission and it was okay for me to be on site.

4.3.2.1 Purposeful Selection of Key Informants

The characteristics of people who are interviewed depends on the research questions one intends to explore (Warren & Karner, 2010). The key informants selected to participate in these interviews were purposefully selected (Creswell, 2007; Devers & Frankel, 2000; Patton, 2002) using the following criteria:

1. They were either an OHS expert, manager, supervisor or worker;
2. The supervisors and workers represented the diversity of trades and work groups who worked on site;
3. Both direct employees and subcontractors were covered; and
4. To the full extent possible, all participants had a substantial and ongoing role with SWMS.

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[18] This involved watching a video developed by the Principal Contractor and completing a two-page questionnaire which was then assessed by the site manager.

Managers were defined as those who, above and beyond any trade or other skills, had direct responsibility for managing and organising labour, resources, and work activities, or were in involved in the OHS function of the organisations. These included construction managers, site managers, project managers and health and safety personnel, but did not include health and safety representatives. Supervisors were defined as those who were responsible for the day-to-day management of different construction projects or activities within the projects, those who had any role in deploying, reviewing and auditing SWMS, and those who provided direct supervision as part of their day-to-day jobs. These included roof plumbing supervisors, roof tiling supervisors, building supervisors and foreman. Workers were defined as those who, because of their skills, trades and certification, worked either on their own or under supervision, and applied their trade and skills to particular tasks in the construction projects. These included carpenters, concreters, plumbers, roof plumbers, roof tilers, carpenters, machine operators, drainers and apprentices, who were employed either as direct employees or through contracting and subcontracting arrangements.

4.3.2.2 Rapport Building

Building rapport among key informants is one the most important aspect of any qualitative research, a point that is made by Devers and Frankel (2000):

> '…once approval to proceed with the research has been secured from gatekeepers, the researcher must begin the process of negotiating and maintaining relationships with individuals or groups of primary interest. Ironically, negotiating access to these individuals may require the researcher to distance him or herself from gatekeepers. The individuals or groups we often wish to study are at lower ranks of the organisation and may be concerned that the researcher works for organisational leaders, shares their views, or will not keep their views and comments confidential (for example, will team members' views be shared with regional leaders?). Therefore, researchers must also get to know the interests and concerns of individuals throughout the organisation and be sensitive to them, without over identifying with any one group or consciously deciding to alter ones' role (e.g., researcher versus advocate). In the initial stages of research, particularly when time constraints permit, collecting data should be secondary to getting to know people and establishing rapport' (p. 267).

At the domestic construction sites, this involved being introduced to the different trades and subcontractors by the gatekeeper, spending time with them both as a distant observer and as a participant observer, watching them do their work, and giving them a helping hand where this was possible. The latter included transporting roof tiles through a roof tiling machine, assisting with markings and set-outs for drainage and excavations and passing hand tools. In some instances, I spent up to three days doing this without conducting any interviews. It meant I was up at the job sites for a 7.00 or 7.30 a.m. start, being out in the freezing cold, climbing up the set of scaffolds or access ladders to be on top of the roof. On the commercial site, this involved spending a week when the excavations for the slab and pad foundations were being dug. Again, this meant being on the site as early as 7.00 a.m., signing in the visitors' book, enjoying a 'cuppa' with the boys before trudging off in the mud and slush, initially with two, then later with up to four people. It also meant becoming a union member for the duration of my data collection in order to be accepted, and following the rules of the site. I needed to ensure that the hard hat I wore on this site had the union emblem, and when walking away from the job when it was raining, that I waited in the purposely-designed shed designated for the different trades. It was here that a lot of the opportunities for socialising and getting to know the participants occurred. I shared the 'smoko' breaks with the coffee, milk, and Milo generously supplied by the principal contractor, sharing jokes with the crew and generally being accepted as one of their own.

4.4 DATA COLLECTION

In this study, I utilised triangulation of semi-structured interviews, field observations, and document analysis as part of the data collection strategy.

4.4.1 SEMI-STRUCTURED INTERVIEWS

I conducted 64 semi-structured interviews: six involving regulators, one in the industry association, 14 in Organisation A, 25 in Organisation B and 18 in Organisation C, as illustrated in Table 6.

Table 6

Interviews across the System

Level of System	Number of Interviews			
Government				0[19]
Regulator				6
Industry Association				1
Organisation	*A*	*B*	*C*	57
Managers	*3*	*3*	*1*	7
Supervisors	*7*	*11*	*3*	21
Workers	*4*	*11*	*14*	29
Totals	14	25	18	**64**

These interviews comprised of 14 focus groups attended by 34 informants and 30 one-to-one interviews (Table 7).

The interviews were conducted between April and November 2011. All interviews were held at a time that suited the participants, and in their normal working environments. The managers were interviewed in regional offices and at project sites. At the office they had access to their company's intranet-based safety management system, which contained the organisation's OHS policies, procedures and samples of SWMS, while on project sites they were able to take me through actual examples of how they would deal with things such as SWMS, induction and interaction with their subordinates as part of their normal work.

[19] The primary source of data collected at this level included documents

Table 7

Focus Groups and One-to-One Interviews across the System

Level	Focus Groups	Informants	One-to-one	Informants	Total Informants
Regulator	1	2	4	4	*6*
Association	0	0	1	1	*1*
Organisation A	4	8	6	6	*14*
Organisation B	6	16	9	9	*25*
Organisation C	3	8	10	10	*18*
Totals	***14***	***34***	***30***	***30***	**64**

Interviews with supervisors were held either at a construction site or in an office environment. All workers were interviewed on site, in their construction work settings, including the ground floors of a half-constructed double-storey apartment, the roofs of a three double-storey buildings, the excavation and trenching sites of a double-storey building and a commercial construction site and the lunch rooms of a new commercial construction site.

4.4.1.1 Framing and Pilot Testing of Interview Questions

Three types of questions were asked using an interview guide. The first included introductory questions aimed at developing a profile of the key informants, followed by a series of intermediary questions examining their specific and direct experiences with SWMS. These were then followed with more in-depth and focused questions derived from the PRDD model. I used probes to obtain more detail and insight from the point of view of the respondents. The aim here was to gain a deeper insight into the extent to which specific actions, changes, processes, triggers, learning and reflection played a role in the four broad points of prescription, repetition, distinction and description. Examples of the interview guides used are presented in Appendices 4, 5, 6 and 7.

The main aim in piloting the interview guides was to test the veracity of the data collection tool. Because of the inability to do this in a construction environment, the interview guides were piloted with postgraduate students who were enrolled in the Graduate Diploma in Occupational Hazard Management at the UB[20]. This program is currently run on a block mode, and a three week residential school is held twice every year. Interest in the research was solicited through a 15-minute presentation following a presentation on risk management, and students who were interested in being part of the pilot were provided with a copy of the Plain Language Information Statement and consent forms. Interest was originally shown by six students, with two volunteering to assist. A focus group was held with a 48 year old male a 54 year old female, both of whom who were managers and largely responsible for managing the OHS functions of their organisations. One person had been involved in writing and deploying SWMS in earlier jobs, and both were involved in writing policies, procedures and work instructions in their respective jobs.

The interviews, which were based on eight questions, lasted about 75 minutes. Included in these questions were sub-questions that asked informants if there were other additional questions they believed needed to be asked, and about their participation in the project. The interviews were recorded on a PANASONIC DS2200 digital tape recorder and saved on a 2GB SIMS card. Details of these interviews were also recorded as field notes and transcribed within a week of the interview. The pilot interviews were used to simplify the interview questions. Based on the feedback received I simplified a number of questions in the interview guide.

4.4.2 DOCUMENTS

A range of documents were collected for this research at different levels of the system investigated. These included regulations, standards, COPs, regulatory impact statements, submissions, handbooks, company policies and samples of generic and work-specific SWMS. The specific documents that were used at each level are covered in the Results section.

[20] Interest in undertaking similar pilot was solicited from other students from the Civil and Mining Engineering, but these did not eventuate because of time-table clashes or study demands.

4.4.3 FIELD OBSERVATIONS

I also used field observations, a strategy that involved long days on the construction sites. The role I undertook can be best described as a participant observer (Marshall & Rossman, 1999, 2011), which required me to be deeply involved in the social world chosen for the research (Iacono et al., 2009; Marshall & Rossman, 2011). Most of the participants knew why I was there and what I was doing. This was achieved through a mix of gatekeeping introductions, meeting and greeting with construction managers, supervisors and tradesmen, observing individuals and groups as they worked, participating in toolbox talks, site inductions and safety observations[21]. Immersion in a spectrum of activities in the construction research settings helped me to hear, see and experience some degree of reality from the view of the informants (Marshall & Rossman, 2011).

Observations can be focused on general or specific issues. In this case, I used a combination of general and focused observations. The general observations were aimed at becoming familiar with how things worked at the ground level, while the focused observations were aimed at obtaining a deeper understanding of 'work as performed' in relation to a number of high-risk construction activities. The selection of focused observations was based on meeting a number of criteria. First, it needed to be a normal part of construction work, because it was here that people learned and adapted to create safety amid an environment of hazards, trade-offs and multiple goals (Rasmussen, 1997; Woods & Hollnagel, 2006) in order to make up for the holes left by the design process (Rasmussen, 1983; Woods & Hollnagel, 2006). The aim here was to gain an understanding of how labourers, tradesmen and mobile plant operators undertook construction work; the hazards, and risks that they faced as they went about their work, and how they negotiated these hazards and risks as part of their daily routines. Second, it needed to include a combination of activities for which SWMS were stipulated under the federal and state workplace health and safety laws, and those for which SWMS were generally used by the industry. Third, it was preferred that a number of the activities chosen were common to both commercial and residential construction. The aim here was to obtain some diversity and richness in the data, and to see if there were any subtle or more pronounced differences in either the prescription

[21] Safety observations are a common form of behavioural-based safety initiative that is used in a number of large organisations to audit and/or monitor how people work. It generally includes an inspection by members of a health and safety committee, and involves a checklist.

or practice of safe work. Fourth, the activities were those that could be observed without stopping the progress of work. This was based on the need to ensure that in making the observations (i) neither the researcher nor the informants were subjected to any additional health and safety issues outside of those that normally exist in a construction environment, and (ii) there should not be any stoppage of construction work resulting in a financial loss to the subcontractors.

I observed three construction activities that included working at heights, use of mobile plant and trenching and excavation. Table 8 lists the combination of different activities chosen and the contexts of the SWMS across the three organisations.

Table 8

Observations across the Three Organisations

Work Contexts for SWMS	Org A	Org B	Org C
Working at Heights			
Roof Plumbing	√	√	
Roof Tiling		√	
Mobile Plant			
Excavator	√	√	√
Crane			√
Trenching and Excavation			
Foundation		√	√
Draining	√		
Excavation			√
Plumbing	√		√

What became apparent during my general observations was that a lot of the activities on the two domestic sites would be completed in relatively short periods of time, ranging from half a day to about three days. Hence, observing resilient performance would prove to be difficult. For this reason I chose to pay particular attention to any 'episodic adaptations' (Grøtan, 2011; Grøtan, Størseth, Rø, & Skjerve, 2008) that occurred during the course of my observations.

4.4.3.1 Episodic Adaptations

It has been suggested that resilience manifests as episodic adaptations comprised of 'clusters of potentially dispersed activities', with each contributor being constrained in terms of the available resources, time and decisions made in organisations amid natural contexts (Grøtan, 2011; Grøtan et al., 2008). Such adaptations, according to the authors, can be observed as 'pockets of order' and analysed through the REL model. I believe these adaptations can be explored in normal construction work by observing how workers react to regular threats, such as changing weather conditions for outdoor work or work involving heights.

4.5 DATA ANALYSIS

Unlike quantitative data, qualitative data consist of interview transcripts, field notes and images rather than numbers, and analysis is required to make sense of the mass of data that has been generated. A systematic, well-thought out procedure for analysing qualitative data is necessary for assessing the quality of a study. Given the key role that data analysis plays in ensuring quality, it is thus surprising that most studies reported on health and safety, construction safety and RE provide scanty details on how the data they collected was analysed. Analysing qualitative data is a critical process that involves working out and making sense of what people are saying, feeling and thinking about from their perspectives (Ezzy, 2002; Patton, 2002). The heart of good qualitative analysis is a well-established link between the researcher's theoretical stance, the assumptions inherent in this stance and constructing the meanings that arise from the data collected.

The focus on meaning can be a distinctive problem in qualitative research. As Ezzy (2002) posits, 'meaning is not a thing or a substance but an activity. This makes it difficult to grasp' (p. 3). Moreover, meanings are not fixed but change constantly as they are created and reproduced in different social situations, with slightly different nuances and importance depending on the nature of the context (Ezzy, 2002). For qualitative case studies that are based on the SI perspective, the notion of symbols becomes paramount because it is essentially through this social object that meaning is created. Hence, it is necessary to understand how symbols are used to create meaning, and how this could be used to inform the data analysis. This is briefly considered in the next section.

4.5.1 SYMBOLS AND MEANING IN SI

Imperative within the SI perspective is the notion of symbols, which Charon (2010) suggests are social objects that are meaningful, a means for representing and communicating and are intentionally used. They are social objects because we create and use them to communicate and represent something to others (Charon, 2010). They are meaningful because they are understood by those who use them (Charon, 2010). They represent something because they refer to something, and they are intentionally used because they hold a particular meaning to those involved in the communication process (Charon, 2010). There are different types of symbols: words, physical objects, artefacts and language. In this research, SWMS represents a form of symbol.

According to Charon (2010), there are at least nine different ways by people use symbols to create meaning in their day-to-day lives. These include (1) naming, memorising and categorising, (2) perceiving, (3) thinking, (4) deliberation and problem-solving, (5) transcending space and time, (6) transcending one's person, (7) imagining and perceiving reality, (8) enabling creative thinking and (9) self-directing. How these occur in actual life will not be discussed here[22]. In this section, I will briefly summarise the first way: naming, memorising and categorising.

Naming a symbol means that it has been *identified* in some way, *marked or distinguished* in some way, and *stored it for later application* (Charon, 2010). By naming something it is possible

[22] Charon (2010, pp. 62-67) expands on these nine ways by which meaning can be created.

to recognise similar social symbols and call them by that name; naming also allows one to apply the same name to another situation without the object being physically present (Charon, 2010). As an example, SWMS can be identified in different ways: as a process rule or a rule for controlling actions in accordance with the Hale and Swuste (1998) criteria; or as a safe system of work.

Once a symbol has been named, it is then possible to *memorise* it, by making *mental notes of the meaning* we have assigned to the object; most of us can also *recall* what it represents (Charon, 2010). As a symbol, language forms part of a complex and efficient memory system, 'one that can be easily activated, whose parts can be easily interpreted, transferred, combined and isolated' (Charon, 2010, p. 63). Citing Hertzeler (1965), Charon (2010) further offers that '…language, functioning as categories of experienced reality, not only facilitate more precise analysis, but also aids in the comparison of one portion of (experiential) data with other portions' (p.63).

Linked with naming is the process of *categorising*; which is used to *discriminate*, *generalise* and *make subtle distinctions* (Charon, 2010). A named category, according to Charon (2010), is gradually understood, described by qualities we discover it has and distinguished from other categories in subtle ways. This understanding will further enable us to think about why things happen, how different categories are related to other categories, and how to use and alter the symbols in our environs that we understand (Charon, 2010). Inherent in this process, then, is an understanding that categorising involves not only describing the codes but also starting to make connections and linkages between the categories.

The above discussion is important from a methodological pint of view because it provides a way forward for analysing and interpreting data that has been collected using SI. As has been discussed, symbols represent social objects; seen in this light SWMS represent a form of social object. The meanings that one ascribes to SWMS will be derived from, and out of, social interactions between the different actors who are involved in its development, deployment and use. From the earlier discussion, this may comprise three internal processes of naming (so that it can be identified, marked, distinguished and stored), memorising (where mental notes are made for later recall) and categorising (which can be used to discriminate, generalise and make distinctions). Seen from a qualitative data analysis point of view, naming is associated with <u>coding,</u> memorising includes attaching <u>memos or notes to the coded data</u>, while categorising involves the development of <u>categories</u> and <u>themes</u>. This is summarised in Table 9.

Table 9

Making Meaning in SI

(Adapted from Charon, 2010, p. 63)

How People Make Sense of Symbols	What is Involved	Equivalence in Qualitative Data Analysis
Naming	Marking Distinguishing Storing for later use	Coding
Memorising	Making mental notes	Memoing
Categorising	Discriminating Generalising Making distinctions	Categories Themes

The discussion above suggests that analysing qualitative data is largely an inductive process, a view that is shared by others such as Sechrest, Stewart, Sticke and Sidani (1996) and Ezzy (2002). However authors such as Ali and Birley (1999), citing Bryman (1988), posit that it is very rare to start with a clean slate. Most academic research is informed from a review of the existent literature; from this theoretical and conceptual frameworks are constructed that provide a rigorous basis for collecting, analysing and interpreting data. As Ezzy (2002) argues, 'rigorously conducted qualitative research does not need to be uninfluenced by pre-existing understandings; rather, it actively engages these pre-existing understandings, theories and assumptions, allowing them to be transformed' (p. xiii).

In this research I derived a conceptual framework of the gap between work as imagined versus work as performed through a synthesis of the RE literature and used it to refine the research questions. Thus I used a combination of deductive and inductive approaches, consistent with others such as Ali and Birley (1999), Borys (2009) and Eisenhardt (1989). The next section discusses the specific approach I employed.

4.5.2 ANALYSIS OF DATA

My approach to analysing the data collected in this study involved 'data reduction', a process that includes continuous focusing, simplifying and abstracting (Borys, 2009; Miles & Huberman, 1994). It comprises a series of six steps condensed from Creswell (2009), Dey (1993a) and Green et al. (2007), and is illustrated in Figure 9. While the process as suggested is set in a linear sequence, in actual fact it was more of a continuous cycle.

4.5.2.1 Raw Data

Three main sources of data were collected for this study, including tape-recorded interviews, documents (including samples of SWMS, organisational policies around SWMS and generic SWMS), photographs taken during observations, and field notes of observations.

The interviews were downloaded on a laptop computer and transcribed using Microsoft 2007 Word[23]. This resulted in 64 interview transcripts comprised of 62 direct interviews and two reconstructed interviews.

Some of the transcribed interviews were member-checked[24]. There were no changes to the transcripts, except for a few typing mistakes. Where these were available and the parties agreed, photocopies of SWMS actually used in connection with three selected activities (use of mobile plant, working at heights and excavation and trenching) were made. Copies of SWMS were also downloaded from a number of industry association websites.

Field notes of observations made during the data collection were recorded in a research diary, and the notes were then reconstructed using a Microsoft word 2007 and saved in a folder entitled 'Observations.' Photographs and video recordings were downloaded onto a laptop and saved in a folder titled 'Images'.

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[23] I transcribed seven (7) interviews, the remaining fifty seven (58) were outsourced to a national transcription service based in Melbourne.

[24] Sixteen (16) interviews were member-checked, which is about 25% of those interviewed.

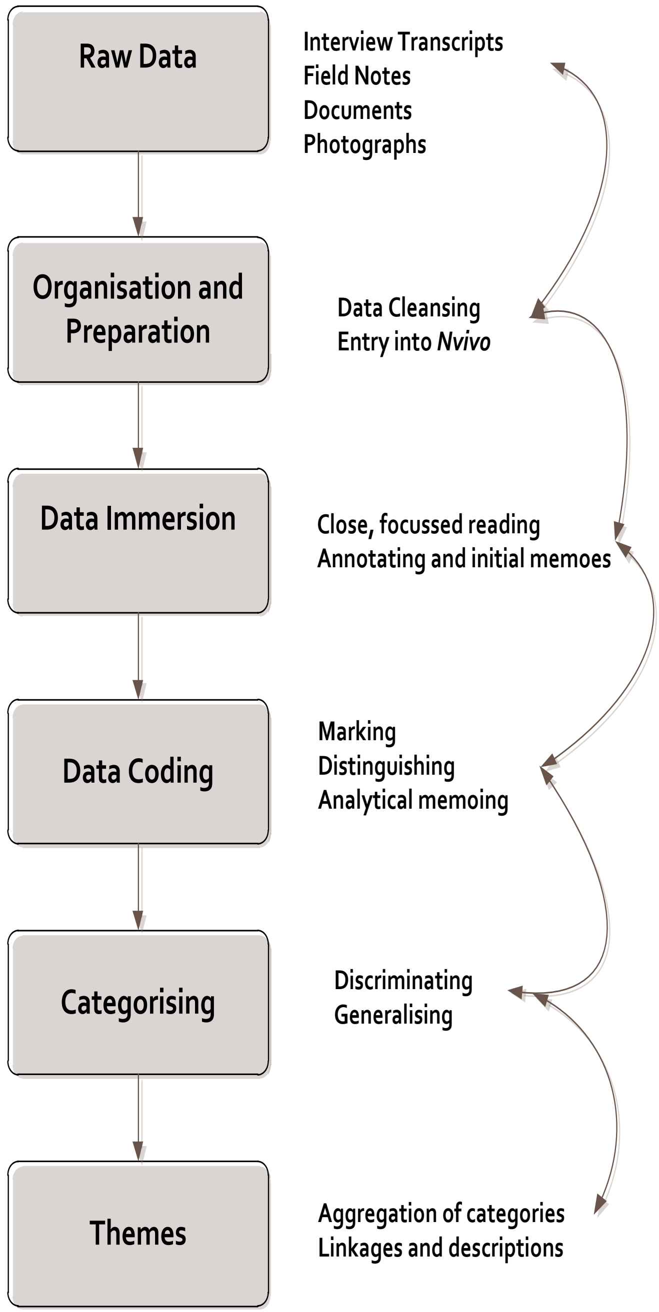

Figure 9: A Six-Step Process for Data Analysis

(Adapted from Creswell (2009), Dey (1993) and Green at al.., (2007)

4.5.2.2 Organisation and Preparation

According to Marshall and Rossman (1999), it is important for researchers to spend some time organising the data they have collected. While this should be an ongoing process, the authors posit that 'revisiting the huge piles of data at this stage are very important' (p. 157). This stage of organising and preparing includes minor editing, general cleaning up and logging the data based on dates, types, places and the manner in which the data was gathered (Marshall & Rossman, 1999). This is the most basic and surface level of organisation. Another important step at this stage involves thinking about how large volumes of data are to be managed; it also includes accessing and using a software program for ease of data management.

All interview transcripts were skimmed and all personal identifiers, including names of persons and organisations were deleted. The names were replaced with a six-digit identifier, ranging from PAR001 to PAR065 (representing participant numbers 1–65). The order in which the numbers were allocated was based on the order in which the transcripts were member-checked and the order in which they were transcribed, not the order in which people were interviewed. Similarly, all identifying information from SWMS, checklists and other documents obtained from the three participating organisations were crossed out using dark ink, and the documents labelled with a six-digit identifier of DOC001–DOC024. A similar process was applied to remove any personal identifiers in the field notes and the observations, labelled from OBS001 to OBS012. The photographs that were downloaded were closely viewed, and all features that could identify either the person or the organisation were faded by contrast. The photographs were similarly labelled from PHO001 to PHO048. Once this process was completed, the data was re-arranged into a total of 20 (20) data sets[25]. Each data set comprised a specific set of documents, interview transcripts, photographs and field notes of observations. The breakdown of the data sets is illustrated in Figure 10, laid out as a socio-technical system structure.

The field notes, observations and documents collected were not broken down any further. The data sets were then downloaded into the nVivo9 software package, which was used to manage the data and assist in the analysis process.

[25] While acknowledging that this creates a relatively large data set, it was decided that arrangement provided the best means of protecting data from being contaminated.

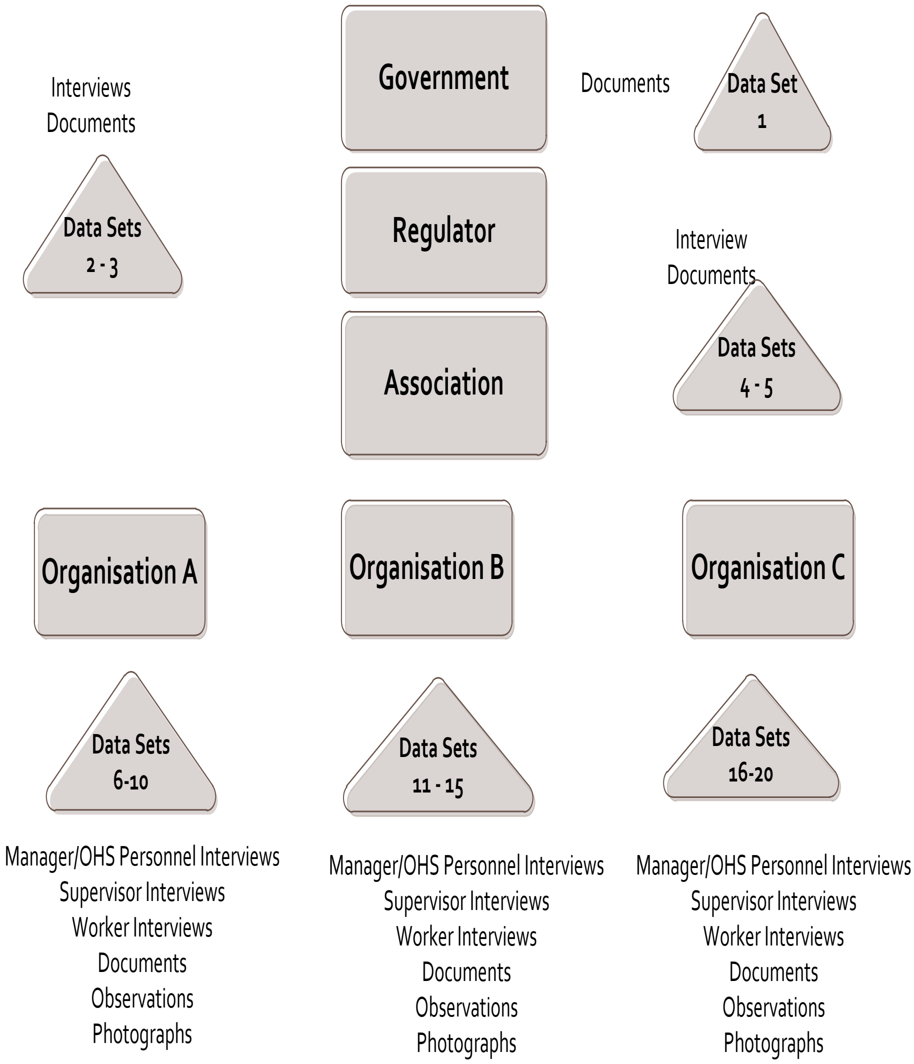

Figure 10: Data Sets across the Construction Socio-Technical System

4.5.2.3 Data Immersion

Once the data collected has been organised and prepared, it becomes necessary to delve deeply into and absorb it, in order to enable one to lay the foundation for connecting the disjointed elements into a clearer picture of the issues being examined (Green et al., 2007). There are two essential steps at this process. The first involves the constant reading and rereading of the interview transcripts and field notes, listening to the tape-recorded interviews and becoming intimately familiar with the data (Green et al., 2007; Marshall &

Rossman, 1999). The second involves writing notes, reflective memos, thoughts and insights in order to 'move the analysis from the mundane and obvious to the creative' (Marshall & Rossman, 1999, p. 161). Dey (1993b) refers to this step as annotating which involves recording observations about the data itself.

Each interview transcripts were read and reread closely many times to obtain a sense of the data. Simple annotations and initial notes were placed alongside sections of the text to identify the possible concepts and ideas that arose. The same process was applied to the annotations and notes were applied to the field notes of participant observations. An example of the initial annotations and notes applied to a focus group interview transcript is shown in Table 10.

4.5.2.4 Coding

Coding of qualitative data is the 'formal representation of analytic thinking' (Marshall & Rossman, 1999, p. 160), a process that forces researchers to make judgements and label blocks of transcripts (Green et al., 2007; Ryan & Bernard, 2003a). As Saldana (2009), quoting Strauss (1987), posits, 'the excellence of research rests in large part on the excellence of the coding' (p. 1). There are different ways in which data can be coded. One involves making notes in the margins of the transcripts, a second involves colour coding using markers and a third involves noting line numbers relating to particular items on a separate page (Green et al., 2007). Authors such as Dey (1993) and Saldana (2009) suggest the use of code books (or code lists) as a guide, while others suggest the use a software package to keep a track of codes. Irrespective of the methods used, coding entails 'conducting a detailed, taxonomic process of sorting and tagging the data' (Green et al., 2007, p. 548).

Saldana (2009) suggests there are two broad strategies (or cycles) for coding; first cycle and second cycle. The first cycle is undertaken during the initial coding, and includes at least seven different methods, while the second cycle includes at least six different methods (Saldana, 2009). These methods include attribute coding, descriptive coding and in vivo coding, which are associated with the first cycle, and focused and axial coding, which are part of the second cycle.

A two-staged approach was used to code the data collected in this study, involving a combination of deductive and inductive strategies. I first established an initial code list, which was derived from the conceptual framework, and which was expanded to include the four essential attributes of organisational resilience suggested by Hollnagel (2009b).

Table 10

Example of Initial Annotations and Notes Applied to a Section of a Focus Group Transcript

		Annotations	Initial Notes
Question	*What do you think a SWMS is designed to achieve?*		
PAR062	Aware of what's going on	Awareness	
PAR063	Makes you check the job. Without it, you cannot do anything.	Monitoring? Re-enactment?	Does an absence of SWMS lead to actual stoppage of work?
PAR062	Yeah, one is required for every job.	Normal?	As opposed to some jobs only.
Question	*How does SWMS achieve this objective?*		
PAR062	Check everything on the form, things can different from this site to another.	Repetition? Possible point of Breakdown / Abnormality	
Question	*Where does understanding come from?*		
PAR062	From their induction	Company training	Formal training?
PAR063	And also from guys you are working with. Just learning on the different jobs.	Team learning	
Question	*Thinking about the most recent SWMS you have used.*		
PAR062	General SWMS for this particular job - drains.	Repetition?	
PAR063	All jobs have a general one we use. Just some things don't apply. Say underground mains here this a new development so we don't tick that one.	Points of break-down or abnormality?	Distinction stage -

The initial coding list is shown in Appendix 8. The code lists was expanded as the analysis progressed. Once this was done, the consolidated responses for each of the questions were closely read and reread a number of times, and chunks of this were marked and labelled. Both descriptive and in vivo coding was used. In applying, descriptive coding the responses and the context were closely considered, and I wrote a description that I believed most closely resembled any of the key words or ideas that were linked with the code descriptors. In vivo coding entailed summarising the phrase or response using a word or phrase directly spoken by the interviewee. An example of how this coding scheme was applied to a section of manager interview is illustrated in Table 11.

I also applied a second stage coding, which was a more in-depth and analytical. This involved identifying detailed concepts and ideas related to broader concepts and ideas encountered in the literature around the PRDD model, safe work practices, rules and procedures and related notions. Analytical memos were written as part of this process to assist in finding categories and themes. These analytical memos included ideas from the literature, as well as my personal understandings and reflections. An example of how a second stage of coding as applied to the above manager interview extract is shown in Appendix 9.

4.5.2.5 Categorising

Generating categories from qualitative data 'involves noting patterns evident in the settings and expressed by participants. As categories of meanings emerge, the researcher searches for those that have internal convergence and external divergence' (Marshall & Rossman, 1999, p. 159). When data is being categorised one is not only bringing related observations or statements together but also identifying why they are together (Dey, 1993b). This can be an ongoing exercise alongside the coding (Green et al., 2007). Categorisation largely involves a grouping of the data, including those that have been coded, in such a way that they can be distinguished in some way (Dey, 1993b).

There are generally two broad approaches for generating categories. One involves obtaining categories from the data itself; this is the emergent, inductive approach. The second is a more deductive approach where one works from a pre-set category, then finds ideas in the data collected to build support for the categories. The more common approach is a combination of the two, and this was the approach used in this research.

Table 11

Example of First Cycle Coding Applied to Portion of Manager Interview

Q	*Where do you actually come in (as a HSE manager for the organisation) in terms of Safe Work Methods Statements?*		
PAR023	For me Safe Work Methods Statements is very much around the process so there is two parts to it, as I tell people. The first part is the, well I suppose one part is the documentation, right the documentation for me is purely worked the same as like a prompt sheet to assist people to, I suppose think through the process, identify hazards and risks and it is very much a prompt, it serves as a prompt sheet for someone. It is like if I ask you to walk into a room and say 'hey let's have a look at some hazards.' In an unfamiliar environment, even if it is a familiar environment, sometimes without some guidance or getting your mind working again in that framework, it can be difficult just to get that thinking working so Safe Work Methods Statement has the advantage or is a great tool to assist people through that process. It also serves as an audit tool as well and that is probably where for me, for the most part, what the Safe Work Methods Statement as a document sits. In saying that, I have never seen a document stop someone getting hurt. So the other key component of completing the Safe Work Methods Statements is I suppose, its practical implementation, and it really sits around the discussion, so the discussion you have with your team. If you are working in a team it is discussion that you have with other people or people on site, whether people on trades, it is that communication, so it is that physical interaction. That is what stops people getting hurt because they are actually now connecting or having a real sort of ... I suppose we are taking ownership of the process rather than just sitting because anyone can sit in a vehicle and just tick some boxes, you know, 'great I have completed the document.	SWMS as a process Document as a prompt Guide SWMS is a tool SWMS as a tool for interacting – source of discussion Audit tool Communication is fundamental SWMS as document gives some sense of ownership of process of identifying and addressing hazards	Identifying hazards Identifying risks For thinking through process To getting started? Does not stop accidents "Communication…that is what stops people getting hurt"

First, a set of categories of data that was intended to be collected was developed by working from the conceptual framework. This meant revisiting the series of sub-research questions relating to each of the four loops in the PRDD model. Table 12 includes an example of my initial list of categories which were derived from the conceptual model and the research questions relating to the prescription of SWMS.

Table12

Example of Initial Categories for SWMS as Imagined

<table>
<tr><th>Where in Model</th><th>Research Question</th><th>Category</th></tr>
<tr><td rowspan="7">Prescriptions Loops</td><td>How are safe work method statements prescribed?</td><td>Process of prescribing SWMS</td></tr>
<tr><td rowspan="3">How is such prescription interpreted?</td><td>SWMS as Imagined by Experts</td></tr>
<tr><td>SWMS as Imagined by Managers</td></tr>
<tr><td>SWMS as Imagined by Supervisors</td></tr>
<tr><td rowspan="3">To what extent does reflection-on-practice play a role in the prescription of SWMS?</td><td>Reflections on SWMS prescription by OHS Experts</td></tr>
<tr><td>Reflections on SWMS prescription by Managers</td></tr>
<tr><td>Reflections on SWMS prescription by Supervisors</td></tr>
</table>

Following this, the coded texts for the interviews, observations and documents associated with the management and health and safety experts were closely reviewed to identify phrases and ideas that were related to any of the above categories. Analytical memos were written against each category to illustrate why these were chosen. Where there was no direct fit with the above categories, similar codes were collated to identify and label and new sets of categories, allowing for further categories to emerge from the coded data. The list was expanded as the analysis progressed. A similar process was used for developing categories associated with the 'SWMS as performed' data. Table 13 lists examples of some of the original categories developed for 'SWMS as performed' from the conceptual framework, which was expanded and refined as the analysis progressed.

Table 13

Examples of Categories for SWMS as Performed

Where in Conceptual Framework	**Research question**	**Category**
Repetitions-Distinctions-Descriptions (RDD) loop	*How are SWMS experienced?*	SWMS experienced by supervisors
		SWMS experienced by plant operators
		SWMS experienced by labourers
Repetitions loop	*To what extent are SWMS assimilated into the work-group?*	SPV assmltn. of SWMS as performed
		LAB assmltn. Of SWMS as performed
	To what extent are SWMS practices re-enacted?	SUP re-enact of SWMS practice
		LAB re-enact of SWMS practice
	To what extent are SWMS reinforced?	SUP reinforce of SWMS practice
		PLO reinforce of SWMS practice
		LAB reinforce of SWMS practice
Distinctions loop	*To what extent is distinction most likely to be experienced in SWMS practice?*	SUP abnormality in SWMS practice
		PLO abnormality in SWMS practice
		LAB abnormality in SWMS practice
	To what extent does this distinction alter SWMS practice?	SUP change to SWMS practice
		PLO change to SWMS practice

4.5.2.6 Themes

There are a number of ways in which one can identify themes in data. Ryan and Bernard (2003b) have suggested that a number of clues can be used, including 'repetitions', or 'topics that occur and reoccur'; 'indigenous typologies', or 'local terms that sound unfamiliar or are used in unfamiliar ways'; 'metaphors and analogies'; 'transitions' such as 'pauses, changes in voice tone, or the presence of particular phrases'; 'similarities and differences' through 'constant comparison'; constant use of linguistic connectors such as 'because, since, as a result, if, the, rather than' in phrases and explanations. Saldana (2009) suggests the most simple way was to pool them together with categories of similar ideas in some fashion. Each technique has advantages and disadvantages; some are more suited to risky, complex narratives, while others are more appropriate for short responses to open-ended questions (Ryan & Bernard, 2003a, 2003b).

The approach for arriving at themes was based on a combination of induction and deduction. The 12 main themes that informs this thesis include (1) safe systems of work, (2) cognitive artefacts, (3) work contexts, (4) control, (5) tools, (6) processes, (7) legal protection, (8) role in safety, (9) reflection-on-process, (10) revisions and changes, (11) monitoring and (12) sacrificial decision-making. The main strategy I used was based on 'repetition'; i.e., where a category appeared to be repeated it was treated as a theme.

4.6 RIGOUR IN QUALITATIVE RESEARCH

An important challenge for qualitative researchers involves ensuring the quality of their research. As has been argued in Chapter 3, there is wide diversity in the way qualitative research is described, and wider ways of describing the specific genres of qualitative research. Because of this diversity in the perspectives, approaches and methods for collecting, analysing and interpreting data, there is no universally agreed set of criteria that can be used to evaluate the quality of research. For positivists (or empiricists), on the other hand, the four most common references are to internal and external validity, reliability and objectivity.

One of the earliest attempts to transfer these evaluative criteria to the social sciences and qualitative research was made by Lincoln and Guba (1985). They suggested the most important criteria by which qualitative research could be evaluated was the trustworthiness of the study. This, according to the authors, can be achieved by meeting the following four elements: (i) credibility, or confidence in the truth of the findings; (ii) transferability, or being able to demonstrate that the findings can be applied to other contexts; (iii) dependability, or being able to demonstrate that the findings are consistent and could be repeated; and (iv) confirmability, or the extent to which the findings are not shaped by participants bias, motivation or interests (Lincoln & Guba, 1985). These authors suggested a number of techniques for meeting the above sub-categories. For example, credibility can be achieved through prolonged engagement, persistent observation, triangulation, peer debriefing, negative case analysis, referential adequacy and member-checking (Lincoln & Guba, 1985). According to Lincoln and Guba (1985), thick descriptions can be used to show transferability, and inquiry audits can be used to establish dependability. Confirmability can be met through confirmability audits, audit trails, triangulation and reflexivity (Lincoln & Guba, 1985).

The procedures and approaches suggested by these authors have been used by many qualitative researchers over the last two decades. However, their criteria contradict their philosophical positions of 'multiple constructed realties' (Lincoln & Guba, 1985, p. 294); hence, a decade later they expanded their criteria to include authenticity and misapprehension, in addition to trustworthiness (Guba & Lincoln, 1994). According to Seale (1999, 2002), authenticity is demonstrated when researchers are able to show realities from the viewpoints of researchers and participants, so that both may be able to develop more sophisticated understandings of the phenomenon being studied. This, the author argues, also enables one to appreciate the different viewpoints of the different people involved in the research.

Chiovitti and Piran (2003) suggest a set of eight criteria for grounded theory; Denzin and Lincoln (2003) suggested very similar criteria—trustworthiness, credibility, transferability, and confirmability—for constructivist research. Koch and Harrington (1998) argue that reflexiveness was the most important criterion, while Porter (2007) suggested that a realist approach, based on aesthetics and rhetoric, rather than one based on epistemological validity, was the most important. Creswell (2007, 2009) suggested at least eight ways in which verifications could be carried out, including: (i) prolonged engagement and persistent observation, (ii) triangulation, (iii) peer review and debriefing, (iv) negative case analysis, (v) clarification of researcher bias (or reflexivity), (vi) member-checking, (vii) rich, thick descriptions and (viii) external audits (Creswell, 2007, 2009). He argued that any qualitative research should employ a minimum of at least two of the above. In a more recent article, Tracy (2010) suggested eight elements that could be used to demonstrate excellence in qualitative research, arguing that these can be attained 'through a variety of craft skills that are flexible depending on the goals of the study and preference/skills of the researcher' (p. 839), including: (i) a worthy topic, (ii) rich rigour, (iii) sincerity, (iv) credibility, (v) resonance, (vi) a significant contribution, (vii) ethics and (viii) meaningful coherence.

The discussion above suggests that there is wide diversity in the way the quality of qualitative research can be demonstrated, based on the background of the various researchers and their disciplines. To avoid the confusion associated with the terminology and approaches, the quality criteria that I have employed in this research involve rigour in the research process. Two broad elements that I used for maintaining rigour include authenticity and credibility.

4.6.1 AUTHENTICITY

Authenticity is closely associated with validity in quantitative research. As Milne (2005) argues, qualitative research is authentic because the basic objective of such research is to observe and participate in authentic experiences that can then be described and explained to gain a deep understanding of a particular phenomenon. Authenticity links the participant as a person to the phenomenon and situation (Chiovitti & Piran, 2003). Research is authentic when it is reflects the meanings and experiences as lived and perceived by participants (Sparkes, 2001; Whittlemore, Chase, & Mandle, 2001). In order to demonstrate authenticity, researchers need to pay particular attention to subtle differences in voice, avoiding bias and distortion (Whittlemore et al., 2001). In addition, the findings must be congruent with both the participant's and the researcher's experience (Chiovitti & Piran, 2003; Sparkes, 2001). This means they are able to relate to it in some way. There are a number of ways in which elements of authenticity can be demonstrated. Threats of biases and distortion can be avoided by acknowledging the researcher's own biases and perspectives through reflexivity (Creswell, 2007, 2009; Lincoln & Guba, 1985). Congruence can be illustrated by using the participant's actual words, member-checking or thick descriptions (Creswell, 2007, 2009).

The authenticity of this research can be demonstrated in a number of different ways. A small degree of member-checking has been used. This involved taking a transcribed interview back to a series of interviewees, having them check through it, discussing their responses, and obtaining clarifications from them. In addition, I have used thick descriptions extensively, including each participant's own words to the maximum extent possible.

4.6.2 CREDIBILITY

Often used as an overarching term with validity, credibility is closely associated with the notion of reliability in quantitative research. It is equivalent to the notion of dependability in qualitative research (Long & Johnson, 2000). The credibility of such research lies in the way in which the data is collected, analysed and presented. It has generally be acknowledged that the findings of qualitative research cannot be generally replicated because of the nature of the data and the sampling strategy used (Long & Johnson, 2000). However, prolonged engagement with the research, its contexts and participants, persistent observation, triangulation, peer debriefing, analysis of negative cases and member-checking are among some of the methods that can be used to verify research (Creswell, 2007, 2009). These approaches can also be used to establish credibility in the research process (Lincoln & Guba, 1985).

In this research, a number of different approaches were used to maintain credibility. I spent over 16 weeks in the field, approximately a week of which did not entail the collection of data, over eight weeks at the two domestic construction sites, and about six weeks at the commercial construction site. A triangulation of methods was used to collect data. Moreover, the approach that I used for data collection is congruent with the interpretivist paradigm, constructionism and in line with the tenets of SI. Furthermore, the research is based on multiple cases, which Flyvbjerg (2006) has suggested us one way to deal with the perceived limitations of case study research.

Table 14 summarises the approaches that I used to maintain rigour in this research.

4.7 SUMMARY

In the last section I discussed how the a multi-level case analysis was applied through the epistemology of constructionism and the theoretical framework of SI to collect and analyse data aimed at developing a comprehensive understanding of the dialectic between prescription and practice of SWMS.

Table 14

Criteria, Strategies and Examples for Maintaining Rigour

Criteria	Strategy	Examples
Authenticity	Member -checking	15 transcripts of tape-recorded interviews provided to participants for checking and getting clarifications.
	Congruence	Extensive use of thick descriptions. Using participant's own words to the maximum extent possible
Credibility	Prolonged engagement in the field	Over sixteen weeks of data collection. Approximately a week at each research site as part of initial access and gate-keeping (without any interviews). Over eight weeks in the two domestic construction sites. About six weeks at the commercial construction site.
	Use of clear theoretical framework for interviews and observations.	The PRDD model was used to seek responses to interview questions and to make observations on key aspects of prescription and practice of SWMS.
	Persistent observation	Sequencing of semi-structured interviews across all participants allowed researcher to focus on important aspects of the phenomena being investigated.
	Triangulation of data collection	30 x One to one interviews 14 x Focus group interviews Documents Observations

Figure 11 summarises the integrated conceptual and theoretical framework of the research.

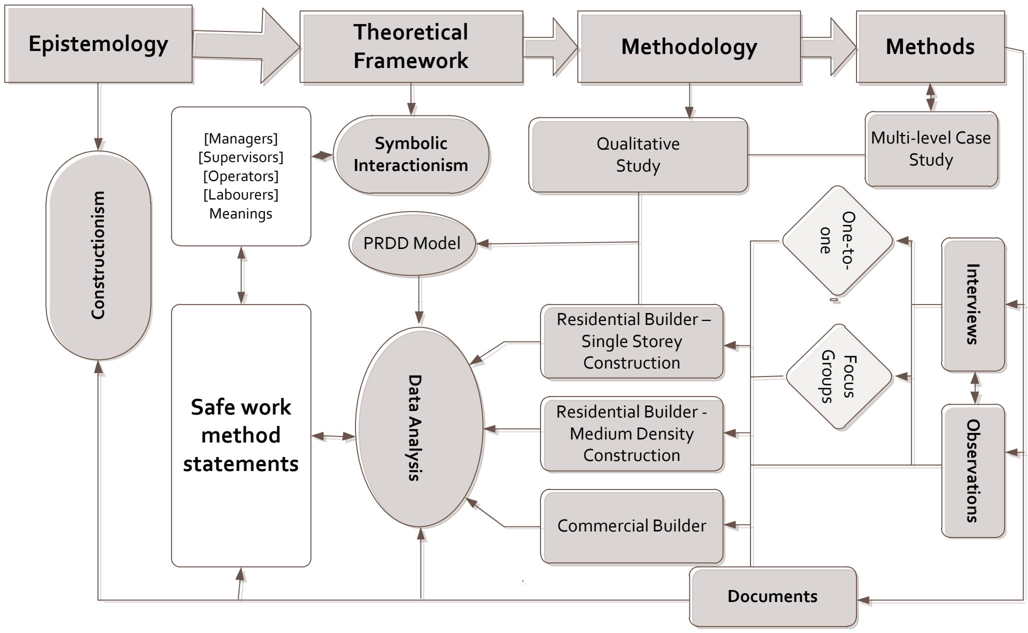

Figure 11: Integrated Research Framework

4.8 REFLECTIONS

Unlike quantitative studies, in which the researcher is distant from the key informants and research settings, the qualitative researcher is an instrument of the research process itself. As Ezzy (2002) points out, 'the best qualitative researchers do not separate their lives from their research' (Ezzy, 2002, p. xii). As Creswell (2009), citing Locke et al. (2007), points out, this can pose a number of ethical, personal and strategic problems. Thus, it is necessary to identify any assumptions, biases, ideals and personal values in the research. Creswell argues this very point:

> '...inquirers explicitly identify reflexively their biases, values, and personal background, such as gender, culture, and socioeconomic status, that may shape their interpretations formed during a study. In addition, gaining entry to a research site and the ethical issues that might arise are also elements of the researcher's role' (Creswell, 2009, p. 177).

Citing Locke et al. (1987), Creswell suggests that the experience need not be detrimental, but can be positive and useful. Personally, my perceptions, feelings, and thinking about SWMS have been largely shaped by my previous experiences in the legal enforcement of these outside of the construction sector. I have worked as an Inspector for Health and Safety in Victoria for a period of over seven years and hence I have some experience of how SWMS are being used in activities other than mainstream construction. It is therefore possible this bias affected the way I approached the data collection and analysis.

The approach of framing interview questions according to the conceptual framework, the PRDD model, was something that was very new to me. While I tried my best to frame interview questions around this model, it is possible that my previous experiences in seeking information as a health and safety inspector and an auditor will have shaped the data collection, the way I asked the interview questions and the probes I used, the way I view and understand the data and the way in which I made sense of it during my analysis.

My fundamental understanding of RE is based on my conceptualisation of its notion from the literature. For me, the engineering aspect involves some form of 'social engineering'. In this research I have followed the thinking of authors such as Dekker (2006), for whom adaptation of 'work as imagined' and reflected in 'work as performed' is a fundamental facet of RE. However, unlike most other proponents of RE who appear to be psychologists or engineers, I see myself more of a 'generalist' health and safety practitioner, and this is reflected in the way I have collected, analysed and reported the data collected in this study. It may well be that those who come from other backgrounds, such as psychology or sociology, may have used a different approach altogether.

The absence of any interest shown by the construction industry, in particular the commercial construction sector, in SWMS, and the difficulty in getting past the gatekeepers, again in the commercial construction organisations, proved particularly challenging for me. I anticipated that I had an adequate level of preparation, in terms of not accessing research sites prior to the approval for ethics, as advised, being independent in terms of not previously dealing with construction organisations, and seeking to embark on an area of research that is at the forefront of construction safety, could all be useful as I progressed in my research. However, while some of these factors proved useful, they did not assist me to the extent I had anticipated.

In hindsight, I believe some of the ways that I went about the process could be improved. For example, starting discussions early with potential research sites in the construction industry may be a better way for generating interest, and also assist obtaining more 'buy-in' from research sites. Also, conducting research as an 'insider' (Galea (2009) may be a better strategy for gaining access to, developing rapport with, and obtaining a much deeper insight into the way things actually happen on construction sites. In addition, paying some form of compensation to informants, particularly subcontracted employees who give up valuable amounts of their time, could also be useful. However, the ethics of this strategy need to be considered.

In order to ensure an ethical approach to the conduct of this research study I followed the approach used by most qualitative researchers, by seeking approval from the university's research ethics committee before commencing data collection. I believed that this approach would be more than adequate. However, I soon realised that ethical issues permeated the qualitative research process; throughout my research, I was confronted with a number of ethical challenges. Yet there is little in terms of published literatures that discuss how to address these once approval has been granted! Most theses mention the fact that ethics approval was received from the appropriate research ethics committee. How these aspects were actually addressed during the research process is not discussed at all. Here, I concentrate on two ethical issues that challenged me at two different stages of my research journey: recruitment and write-up.

At the recruitment stage, most of the informants for the practice aspects of SWMS were self-employed, contractors and/or subcontractors who are generally paid for the hours they spend doing a job. What this means is that a majority of them may not have the time to participate in interviews because they are not paid for this. Even if they wanted to have an input, many may not be able to. As the type of interviews I conducted lasted between 45 minutes to an hour, I believe financial reimbursements for this important group should not be considered unethical. At the writing stage of my thesis, another challenge I faced was the issue of the 'voice' of the participants. In all I interviewed 64 participants; the ethical issue for me was how many of them would actually be 'heard' through my thesis. To maintain the quality of my research process I knew I had to use excerpts as spoken by my informants selectively; and this could mean some voices were under-represented, some unrepresented, or some over-represented. I believe these types of issues are an under-researched area. How I actually dealt with these issues in this research is the subject of a future research article.

On a personal level, employing qualitative research appeals to me because of its flexibility. Unlike quantitative studies, 'the research process for qualitative research is emergent', hence the research plan 'cannot be tightly prescribed, and all phases of the process may change or shift after the researcher enters the field and begins to collect the data' (Creswell, 2009, p. 176). For this reason, the research designs 'need to remain sufficiently open and flexible to permit exploration of [whatever] the phenomenon under study offers for inquiry' (Patton, 2002, p. 255). I believe this flexibility assisted me to overcome some of the initial difficulties I experienced during the recruitment and selection phases.

In this chapter, I have discussed the research design and the methods for collecting and analysing the data across the socio-technical construction system. In the next chapter, I present and analyse the findings from 'organisational outsiders'.

CHAPTER 5: FINDINGS AND ANALYSIS OF ORGANISATIONAL OUTSIDERS

5.0 INTRODUCTION

The methods used for collecting and analysing data discussed in the previous chapter were aimed at exploring the understanding and experiences of SWMS across the construction socio-technical system in Victoria, for the purpose of investigating whether SWMS enhance or hinder RE in construction. This socio-technical system comprises government, regulators, HIA, management, supervisors and workers, as discussed in Section 4.2.1. For the purpose of this thesis the views of the government and regulator have been combined, and with the associations, are referred to as 'organisational outsiders' (Pillay et al., 2012), while the last three are referred to as 'organisational insiders'. This chapter discusses the findings on organisational outsiders.

The chapter is divided into two main sections. The first includes the combined views of the government and the regulator, while the second includes the views of the association.

5.1 THE GOVERNMENT/REGULATORS VIEWS

The views of government/regulators are based on an analysis of two main sets of data. The first included a series of documents and comprised of standards, regulations, codes of practice, discussion papers, reports, submissions, codes of practice and SWMS for a range of activities (Table 15). The second included interviews with six key informants from the regulator whose profiles are shown in Table 16

Table 15

Documents and Sources from Government/Regulator

Level	Title	Edition
Government	National Standard for Construction Work	2005
	Model Work Health and Safety Regulations	PCC Draft 359.7.12.2010
	Draft Code of Practice- Managing Risks in Construction Work	2010
	Draft Code of Practice – Excavation Work	2010
	Decision Regulation Impact Assessment for National Harmonisation of Work Health and Safety Regulation and Codes of Practice	2011
	Public Discussion paper – Draft National Code of Practice for the Prevention of Falls in Housing Construction	April 2008
	Public Discussion Paper for the Draft National Code of Practice for the Prevention of Falls in General Construction Parts 1, 2 and 3	August 2005
Regulator	Occupational Health and Safety Regulations 2007	
	Compliance Code: Prevention of falls in General Construction	2008
	Job Safety Analysis	Web
	New Safety Rules for Construction Work	20008
	Working Safely in the General Construction Industry: a Handbook for the Construction Regulations	2008 Edition No. 1
	Working Safely in the Housing Construction Industry: a Handbook for the Construction Regulations	2008 Edition No. 1

Most of these were middle-aged men who held vocational and tertiary qualifications in health and safety, engineering and workplace inspection. Their experience in construction ranged from four to 39 years, with 1–21 years in the current organisation.

Table 16

Profile of Regulator Informants

Informant	Position	Age	Education / Training	Experience in Cons. (years)	Experience in Org. (years)
PAR044	Inspector	55	Grad Dip OHS	4	11
PAR045	Inspector	60	Dip in OHS / Dip in Gov.	39	1
PAR046	Inspector	46	Dip in Gov.	36	21
PAR047	Inspector	46	Dip OHS	30	9
PAR048	Inspector	32	Dip OHS	19	4
PAR049	Inspector	39	B. Eng.	16	7.5

The main themes that emerged from an analysis of these two sets of data suggested that SWMS were (i) a safe systems of work, (ii) a live strategy for controlling risks and (iii) applicable to a set of work activities, (iv) a cognitive artefact for thinking planning and thinking about the work, and (v) a tool for initiating social interactions. At this level there is also a 'quality standard' for SWMS, although what this quality is varies.

5.1.1 SAFE SYSTEM OF WORK

One way of capturing the various understandings of SWMS is that it is a safe system of work, one that 'sets out the method that will be used to undertake a particular task and the way that any hazards and risks associated with that task will be controlled' (National Occupational Health and Safety Commission (NOHSC), 2005b, p. 16). The 'system of work' includes the method, or way the proposed work is expected to be done, and the 'way hazards and risk of the work are to be controlled' suggests it is about safety.

It is acknowledged at this level that SWMS are very similar to a similar system of work known as 'job safety analysis' or JSA (National Occupational Health and Safety Commission (NOHSC), 2005a; WorkSafe Victoria, 2008b, 2008c). Rozenfeld, Sacks, Rosenfeld and Baum (2010) suggest that in the context of construction a JSA involves a method of identifying hazards and focuses on the relationships between the worker, tasks, tools and the working environment, with the intent of eliminating or reducing risks to an acceptable level (Occupational Safety and Health Administration, 2002). The reference to elimination and reduction suggests that a JSA is targeting higher-order controls in the traditional hierarchy of controls, instead of lower-end administrative controls such as rules and/or procedures. These views about safe systems and being similar to a JSA were echoed by at least two informants:

'..they were called JSA's then'… PAR045

'…it looks at the tasks that need to be undertaken, what are the hazards and risks associated with those tasks that need to be undertaken and what are the risk control measures that you're going to put in to mitigate those risks'… PAR048.

For the second informant the SWMS provides linkages between the task, hazards and risks of the task and the risk control measures that will be used. In some ways, this reflects the intentions of JSA, which was earlier suggested to be aimed at mitigating risks.

5.1.2 A LIVE STRATEGY FOR RISK CONTROL

Another view of SWMS at this level is that it is a live strategy for controlling risks. They are live because (i) they are required to be developed before the work actually commences and (ii) maintained up-to-date during the course of the work. The expectation that SWMS are developed before work actually commences is expressed by the government and the regulator:

'7.36 A person with control of a construction project must ensure that:

each person with control over high-risk construction work, including subcontractors and self-employed persons, gives the person with control of the construction project a written safe work method statement for the high-risk construction work to *be carried out,* ***before commencing that work****' (emphasis added)* (National Occupational Health and Safety Commission (NOHSC), 2005a, p. 20).

'before any high-risk construction work is done (emphasis added), the employer must ensure that a safe work method statement is prepared…' (WorkSafe Victoria, 2008b, p. 16).

Both statements make it explicit that SWMS need to be in place before the work commences. The expectation that SWMS are live includes keeping them up-to-date after the work has commenced:

'7.3.6 A person with control of a construction project must ensure that:…(b) all such safe work method statements are kept up-to-date and reviewed whenever there is a change…' (National Occupational Health and Safety Commission (NOHSC), 2005a, p. 20)

There a number of points during work that require reviews, and where warranted, a revision to the system of work. Three such points include (i) changes to the ways of working, (ii) changes in the systems used or (iii) changes in location of work (Safe Work Australia, 2010b) (OHSR 2007, p. 280). These points can be suggested to provide opportunities for reflection, trigger reviews and, if necessary, revisions in the SWMS.

The view of SWMS being live was also echoed by some informants:

'…look; this is what I call a live document...'PAR045

'...It's not one you just make and put in your toolbox. It's a live document which has to be continually evolving as your job evolves…'PAR045

For this informant keeping the SWMS live involves it evolving along with a job. Another expressed this view in the following way:

'…SWMS should be treated as a live document in that they might go through detail in the SWMS of how they're going to do the works etc. but in any given time things may come up where they're going to alter how they're going to conduct a particular task. So it's no use going back to a SWMS where it's no longer relevant so it's a live document so if anything changes then a SWMS should then be changed to reflect any of the changes…' PAR049

For this informant keeping the SWMS alive is about ensuring the written document is relevant to the work at hand. This is because although a system of work has been documented, the way things are done are going to change and the written document is no longer relevant. For this reason any changes in the work need to be reflected in the written document.

5.1.3 WORK CONTEXTS OF SWMS

The need for SWMS appears when the activity being undertaken involves a particular set of construction work, and not all construction work. Both the government and regulator stipulate SWMS come into play when doing 'high-risk construction work'; this includes at least 19 specific activities discussed earlier in Section 1.6 and highlighted in Table 3. In this regard, SWMS are actually required for a narrow range of work activities. Thus, construction work that involves activities such as bricklaying, framing and concreting do not necessarily require a SWMS. In addition, the laying of concrete foundations for single-storey buildings and plumbing and drainage works may only necessitate a SWMS when this is being done by an excavator, a type of mobile plant. Moreover, the construction of pre-fabricated homes, and the pre-fabrication of precast concrete panels or roof trusses at a workshop do not require a SWMS (Safe Work Australia, 2012).

The distinction that is used by front-line regulators is to use the term designated high-risk work (DHRW), as expressed by the following:

'We just look to see if they have got a (SWMS) when they are doing designated high risk work…' PAR 044

However, a subtle difference between the government's view and that of the regulator is that SWMS are not an automatic requirement if defined DHRW is being undertaken. According to the regulator SWMS are needed '*if there is a health and safety risk of any person arising from the work* [emphasis added]' (Anstat, 2007, p. 279). However, the guidance issued by the regulator leaves out the fact that SWMS are required if there is a risk to health and safety. Hence, SWMS are required for any work that has been designated as high risk (WorkSafe Victoria, 2008b, 2008c). This may be a cause of confusion in the industry through the generation of documents for work activities even though they are not legally required because they do not form part of the 'designated' high risk work. This is something the front-line regulators frequently encounter on the jobs they visit:

'Well a lot of people do SWMS for work that is not designated high risk. Some companies will have (SWMS) for many of the tasks they do but others will not …' PAR044

'Lots of people do (SWMS) even though they don't need them…'PAR045

'If it's not high risk work it's not a requirement to have SWMS. They still have to have a safe system in place to manage any risk associated with the work…'PAR048

In terms of enforcing SWMS, front-line regulators generally take more interest in those SWMS that are for designated high risk construction work:

'I only look at the ones for high risk work, I don't look at the other ones because I am the regulator, I am not interested in them…' PAR044

It is useful to note here that, apart from the list of the high risk work in the regulations, specific guidance issued by the regulator attempts to provide some real examples as they relate to general construction and to the housing sector (Appendix 10). These examples serve to provide the context of activities which are the subject of SWMS.

What is not clear, however, is how these defined activities were identified as being high risk, or higher than the level of risk, that will normally be experienced in the industry. More specifically, what is the philosophical argument for defining the list of high risk activities? This appears to be an area of further research. *It can therefore be suggested that the philosophical basis for defining a list of high-risk construction activities in the national standard and the harmonised regulations is an area of further investigation.*

5.1.4 A COGNITIVE ARTEFACT

Another common theme that emerged at this level was that SWMS represent a form of cognitive artefact (Jones & Nemeth, 2005; Norman, 1991). According to these authors, such artefacts significantly amplify the basic purpose of physical things one uses in daily life. How SWMS act as such are expressed in the following excerpt:

'Preparing a SWMS is part of the planning of the work' (WorkSafe Victoria, 2008b, p. 16; 2008c, p. 12)

'Well, a SWMS is just to demonstrate that you have thought through the process of how you are going to do the job… 'PAR044.

'Well, they're designed to achieve so a task can be done in an organised sequence…' PAR 045

According to the above excerpts, SWMS can be used for planning and organising the work at hand, by thinking about the process of work, including the sequence in which it is going to be executed. This planning is expected to start well before the work starts, and usually revolves around hazards, risks, and means of controlling them:

'…The SWMS is designed to help employers think through the hazards and risks involved in the work, and to choose effective control measures' (WorkSafe Victoria, 2008b, p. 16; 2008c, p. 12)

'To make people involved in carrying out the activity stop and think about how they're going to do it…, rather than getting half-way through a job and thinking, 'oh, gee, how am I going to get up there now? How am I going to finish this bit?'…PAR047

'It gives the people who are undertaking the task a chance to sit there and actually identify what hazards may be present in the work they're about to do and then gives them the opportunity to look at well we've identified that there's these hazards how are we going to control these hazards'…PAR048

The two most predominant types of hazards and risks that can be identified easily at this stage include anticipated (regular) threats and unanticipated (irregular) threats (Westrum, 2006). Anticipated, or 'regular threats are those that occur often enough for the system to develop a standard response' (Westrum, 2006, p. 56). For example, if the construction work involves roof plumbing for a two-storey construction, the most regular threat is the potential to fall off from the edges. This is a regular threat for this part of the sub-system, part of the 'normal' accidents or events that occur in construction. The outcome of a fall from here can be easily predicted. There can be a fatality, a serious personal injury, or a near-miss, depending on what is there to stop the fall or the environment where the person falls. The standard response to this type of hazard or risk involves the use of fall prevention systems (such as fencing, guard rails, toe boards and working platforms) or fall arrest systems such as safety nets and safety harnesses (Safe Work Australia, 2012). Similarly, if the weather becomes windier there is an increased risk of people falling, and of aluminium sheets flying off and hurting someone if they are not permanently secured in some way. The standard responses to these hazards and risks would be to stop the work if such conditions are being experienced.

Unanticipated, or irregular threats, are a more challenging one-off event are much more difficult to be prepared for and to deal with 'because there are so many similar low-probability but devastating events that might take place; and one cannot prepare for all of them' (Westrum, 2006, p. 57). It is possible that such threats are identified or missed altogether, depending on the skills, experiences and competencies that exist at that particular point in time. Having a SWMS will, at a minimum, force people to think about the hazards and risks of the additional tasks they may not have been previously exposed to on the site, for example, digging up a trench next to an area where roof tiling is going on, as opposed to digging a trench only or doing roof tiling only. In this case the amplification is around dealing with a range of hazards and risks collectively instead of individually, or dealing with hazards and risks they may not have dealt with before. This is made clear in the following excerpt:

'Well, they have to actually think about how they're going to be carrying out the tasks. If they have to unload materials, where are they going to put them? How are they going to lift them to where they need to be worked on, where they need to be used? What qualifications, if you say unload materials in a loading bay from a big site, okay, they're unloaded there, how am I going to get them to where I need them up the second floor? Okay, I'm going to need a crane crew, I'm going to need guys with experience with dogging or rigging maybe, and then I've got to get them up there to fit them all. What qualifications, what people am I going to need up there to actually do the job...If they've got a crane sitting there or they're—so, they've actually gone through the motions of thinking, how am I going to get this from there to do the job I need to do?' PAR 047

According to this informant, SWMS extends the thinking to include the whole aspect of the job that needs to be done. This includes thinking about delivery of materials, resources, licensing and certification of people for specialised tasks. The thinking is expected to extend beyond the boundaries of the immediate work, by considering other contingencies such as the interactions between the different trades. Again, this supports the view that SWMS are a form of cognitive artefact.

5.1.5 A TOOL FOR SOCIAL INTERACTIONS

Another theme that emerged was that SWMS are a tool for interacting with people. One form of this interaction involves consulting with people involved in the work:

'Employees, HSRs [health and safety representatives], as well as contractors and their employees, must be consulted in the preparation of the SWMS so far as is reasonably practicable' (WorkSafe Victoria, 2008b, p. 16; 2008c, p. 12)

The regulator sees this consultation as including a range of actors, including workers, HSRs, contractors and their workers. The government also sees this as an important part of the process:

'7.2.9 A person with control of a construction project or control of construction work must ensure there are arrangements for:

- *all persons engaged to undertake construction work at that site, or their representatives, to be consulted, in a timely fashion, on work-related matters that may affect their health and safety; and*

- *consideration of the views, on health and safety matters, of persons engaged to undertake construction work, or their representatives'* (National Occupational Health and Safety Commission (NOHSC), 2005a, p. 17).

According to the above, consultation needs to be timely, deal with work-related health and safety matters, and provide an opportunity for HSRs and workers to air their views on the work they are expected to perform. The need for consultation is demonstrated through recent evidence that suggests it is an important part of achieving high levels of safety (Ayers, Culvenor, Sillitoe, & Else, 2012; Johnstone, Quinlan, & Walters, 2005; Walters, 2010; Walters & Frick, 2000). What is perhaps important to note here is that consultation acts as an important avenue for social interactions through which social construction of safety (Gherardi & Nicolini, 2000, 2002b) could be achieved. These social interactions are expected to occur, both with workers and HSRs, during the development of SWMS, and across the work cycle of the work:

> *'Workers and their HSRs should be consulted in the preparation of the SWMS. If there are no workers engaged at the planning stage, consultation should occur during worker construction induction training, when the SWMS is first made available to workers, or when it is reviewed'.* (Safe Work Australia, 2012, p. 18)

It has been suggested that construction offers the greater possibility of influencing safety at the conceptual and design stages (Swuste et al., 2012), so the expectation is that these interactions with workers will occur at this stage. However, it is not unusual for construction work to have no workers at the design and planning stage; it is only after the project design has been approved and a principal contractor engaged that direct opportunities for social interaction occur. Hence, the government has identified a number of other opportunities for these social interactions to continue to occur if they have not occurred at the planning stages. One such opportunity is the induction training that is expected to be provided to workers when they are engaged for work. According to Briggs and McCabe (2012), there are at least three different types of induction training, including: (i) industry induction (commonly known as the 'white card' training, (ii) site induction normally provided when a new worker is engaged for a job and (iii) task induction, which is expected to be provided when a specific work is to be undertaken. The first is usually provided off-site, usually through a registered training organisation (RTO), while the other two are site-based. It is here that the opportunity for such interaction exists. The social interactions are expected to include any SWMS developed for the work in question, and these interactions are expected to be repeated when the SWMS for the work are reviewed and/or revised.

A second form of interaction involves informing people about the work at hand:

'It is to inform the employees how to do the job, that's what it should be for … This is how we we're going to do the job and this is the system of work that we're going to use'. PAR046

'Yeah, it's designed to inform the people how to do the job, yes, what equipment they are going to use'. PAR046

Informing involves communication, one of the fundamental requirements for achieving high levels of safety performance (Ayers et al., 2012; Briggs & McCabe, 2012; Cheng et al., 2012). It is a particularly powerful way of engaging with people with lowers levels of literacy, apprentices and unskilled workers.

A third form of interaction involves ensuring those who are responsible for carrying out the work are actually involved in developing the SWMS. The importance of such interaction is expressed by the following informant:

'It's no point in having someone sitting in an office who may have done the work previously, writing out one and then saying, "Here, this is for you to do". It has to be done by the people, they're organised by the people who are doing the job because they're the people who do the job, they're the best ones qualified to write it and they're the best ones of course to later on carry it out. And, if it needs reviewing, they're the best people to review it as well'. PAR045

For this informant, reviewing of a SWMS also involves engaging with people who are expected to be doing the work. Completing a SWMS in the office and handing it out for someone to follow is not good enough because it is devoid of context; engagement with those who do the job are better qualified to write the SWMS for they will be the ones using it. This finding is also consistent with Antonsen et al. (2008), whose research revealed that the broad and direct participation of workers played a key role in the successful implementation of procedures.

Another opportunity for interactions are during toolbox talks (Safe Work Australia, 2012). These are 'short discussions on specific health and safety topics relevant to the task' (Safe Work Australia, 2011, p. 12). They have been widely used in industries such as oil and gas and mining, and can act as a practical point of social interaction, not only with direct employees but also any contractors and subcontractors hired for specific tasks. Such talks 'can be used to convey health and safety information to and receive feedback' and 'also assist in raising awareness of how the construction work will be conducted in healthy and safe manner' (Safe Work Australia, 2012, p. 11).

The above discussed the view of SWMS from the perspectives of the government/regulator, the main findings of which are summarised in Figure 12.

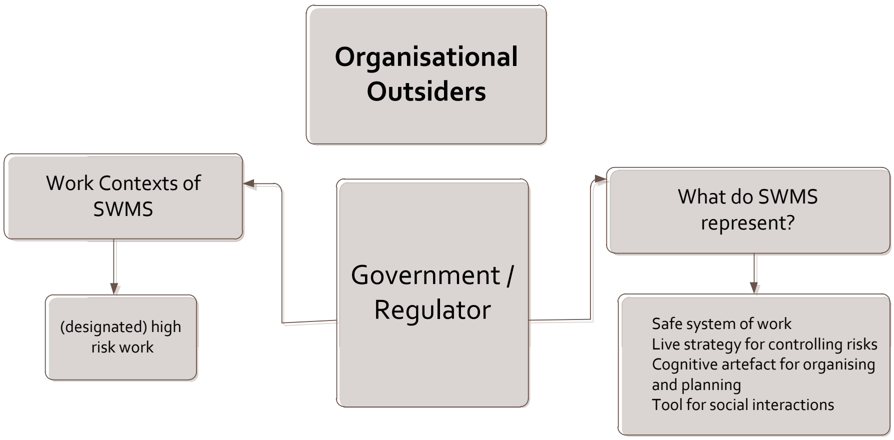

Figure 12: The Government's/Regulator's Perspectives of SWMS

5.2 THE ASSOCIATION'S VIEWS

The next level of players in the socio-technical system includes associations; these are generally employer and employee associations, whose main role is to advocate for their members. This section includes findings from one employer association who chose to participate in the study, based on an analysis of discussions held with one informant, an OHS expert, and a review of documents (see Table 17).

The two common themes that emerged from the data at this level of analysis suggest that: (i) SWMS were a form of control and (ii) that they were required for all trades and activities. The association also have a defined criteria of what they believe needs to be included in the 'document'.

Table 17

Sources of Data—Association

Informant	OHS Expert	
Documents	Submission to Safe Work Australia on Model WHS Regulations and Model Codes of Practice	April 2011
	SWMS – Working near deep excavations	
	SWMS – Use of scissor lifts	
	SWMS – Working off ladders	
	SWMS - Trenching	
	SWMS – Timber framing	
	SWMS – Forklift operations	

5.2.1 A FORM OF CONTROL

The association involved in this study has not defined what a SWMS is; if there is one, it has not been publicly expressed in the documents they supply and maintain on their websites. However, they *'see SWMS as a very critical component of safety management, especially in construction' (Association informant)*. According to this view, SWMS is an element of safety management. This latter term has a number of definitions, but a most recent one by Hollnagel (2008a) is 'a kind of control … of organisational functions and practices that together produce safety' (2008a, p. 2). Seen this way, SWMS represents a form of control for bringing about safety. However, whether this control is exerted as a 'process' or as an 'action' according to the Hale and Swuste (1998) criteria is not really clear.

5.2.2 WORK CONTEXTS FOR SWMS

The association has a general view that SWMS should be limited to construction work activities. However, they believe that there is no need to suggest the term 'high risk work'; a position they made clear in a recent submission:

'[The Association] considers that the regulations should not use the term; high risk construction work;. All the types of construction work listed in this regulation can be performed safely by the application of appropriate risk controls'. (2011, p. 61)

They use an example to demonstrate the following point:

'If a painter is painting a wall and there is energised electrical installation behind the wall, the painter would be required to complete a Safe Work Method Statement … even though there is no risk arising from the energised electrical installation. As the Safe Work Method Statement must include the hazards and risks 'associated with' the high risk work (rather than the hazards and risks of that work) the Safe Work Method Statement would not need to cover the hazards and risks of the energised electrical installation (there are none) but associated hazards and risks (such as manual handling)'. (2011, p. 61)

The submission goes on to argue that SWMS should not be an automatic requirement but come in only *if there is a risk to health and safety*. In terms of the types of construction work to which SWMS are relevant, it appears the association believes all construction work should be the subject of SWMS. This is evidenced by an observation that there were at least 41 different SWMS available on its website at the time the data were collected, listed by trades, work and/or equipment used. The list is in fact twice that suggested by the government and regulator, and includes different trades, work activities and equipment. What appears to be different, however, according to this view, is that it is possible that a work activity could be expected to have more than one SWMS. For example, roof tiling on a domestic housing construction could be the subject at least 13 different SWMS (see Table 18).

If this is in fact adopted by the association's members, it can become problematic for a small subcontractor who is engaged to do roof tiling. They have to negotiate these SWMS, revise them to suit their work as necessary, even before work can commence. It is exactly these types of impositions that are likely to add to the regulatory burden of safety compliance to the smaller players, in this case driven by the association instead of the regulatory body.

Table 18

SWMS for Roof Tiling on a Domestic Housing Construction According to the Association

SWMS no.	Title
7	Working at heights
26	Site safety access – roof tiling
27	Safe roof access – roof tiling
28	Use of petrol motors – roof tiling
29	Safe use of nail guns – roof tiling
30	Fitting timber battens (non-sarking) - roof tiling
34	Tile elevator operation – roof tiling
35	Loading and laying roof tiles
36	Hand cutting roof tiles
37	Mechanical cutting roof tiles
39	Bed and point hips and top ridge – roof tiling
40	Bed and point gable ends – roof tiling
41	Mixing sand and cement mortar – roof tiling

The above section summarised the views of SWMS from the perspective of one association; the two most common views being that they are: (i) a form of control and (ii) applicable to all work and trades.

5.2.3 SUMMARY OF ORGANISATIONAL OUTSIDERS

This chapter discusses findings from two levels of organisational outsiders, including: (i) combined government/regulator and (ii) association. These views are summarised in Figure 13.

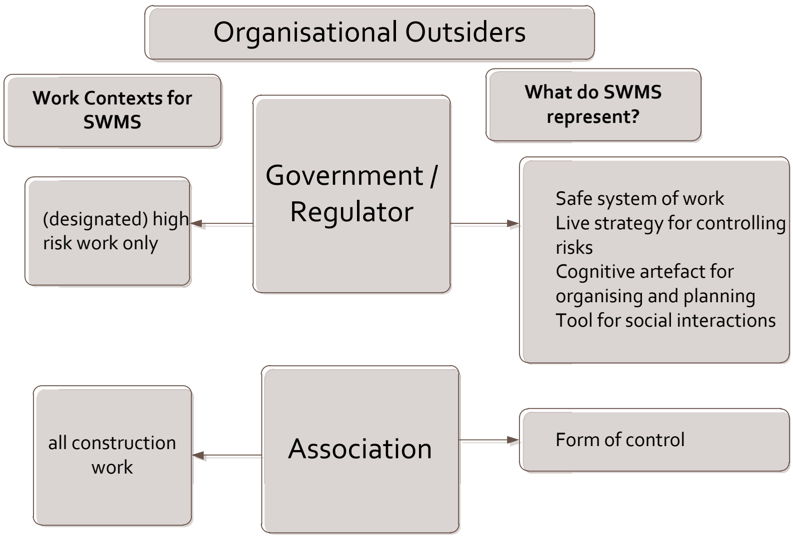

Figure 13: The Organisational Outsiders' Perspectives

5.2.3.1 Comparisons between Organisational Outsiders

The summarised perspectives between two organisational insiders investigated, illustrated in Figure 11, seeks to suggest a wide diversity of views regrading SWMS. While the government/regulator largely saw SWMS as a safe system of work, a live strategy for controlling risks, relevant to (designated) high risk work activities, a cognitive artefact for planning work and as tool for social interactions, the association saw these as form of control, and relevant for all works and trades. With respect to the latter, the association is of the belief that SWMS should not be automatic requirement, but kick in if there is a risk to health and safety. In this light, this view appears to be closer to the regulator than the government.

Whilst not clearly expressed, there appear to be three ways in which SWMS contribute to safety. The first, according to the government/regulator, is SWMS acting as a cognitive artefact for planning where it is expected to assist in making one aware of hazards, risks and in planning about measures for controlling risks. The second is as a tool for socially interacting with workers (through consulting, informing, involving workers in the process of development and implementation, and training. And thirdly, from the view of the association, SWMS act as a form of control for addressing safety issues.

What appears to be clear from a comparison between the two main groups of organisational outsiders that the association investigated here appears not to have been influenced by the government/regulator? An interesting question that arises here is the extent to which of these outsiders influence the understanding of SWMS in the three organisations. This will be made clear once we have an understanding of the views from the organisational insiders; which is covered in the next chapter.

CHAPTER 6: FINDINGS AND ANALYSIS OF ORGANISATIONAL INSIDERS

6.0 INTRODUCTION

The previous chapter discussed the findings of organisational outsiders, including the government/regulator and association. In this chapter, I present and analyse the findings of the organisational insiders investigated.

The chapter is divided into three main sections, each of which is dedicated to the three construction organisations investigated. Each section includes a background of the organisations that has been further divided into three main sub-sections to capture the views of managers, supervisors, and workers.

6.1 ORGANISATION A VIEWS

Organisation A is domestic residential home builder and is a member of the Victorian Volume Home Builders Safety Alliance (VVHMSA) and MBAV. It has been operating in Australia for over six decades, hence has cemented itself as a leading home builder in Australia. It employs a highly experienced and skilled team of engineers, architects and design workforce. As a company that moves with the times, this organisation designs and sells homes to a wide diversity of customers, ranging from early starters, growing families, retirees and investors.

The company runs a medium-density construction business as a separate entity. It has a dedicated health and safety function that comprises two experts and an intranet-based safety management system that can be accessed by all contract managers and supervisors. SWMS are one element of this system, and are audited at two levels. An initial (basic) audit involving 'paperwork checks' is done by the building and construction supervisors for the trades they have engaged, while a more in-depth audit is done by OHS experts as part of planned site safety audits. In relation to SWMS, the general approach taken by Organisation A is to make available to managers and supervisors templates of 'generic' SWMS. While the organisation has over 80 generic SWMS, it does acknowledge that the use of SWMS among the subcontractors it engages is generally low.

The three research sites at which data were collected included two regional offices, a medium-density construction project and drainage works at a new medium-density domestic residential site.

Two different stages of construction work were selected for study at this site. The first involved drainage and excavation works for a single-storey building being constructed in north-eastern Victoria. This work was undertaken by two subcontracted workers. The drainage and excavation provided the context for two different types of SWMS; one involving the drainage and excavation, the other use of a mobile plant.

The second stage involved roof plumbing of a medium-storey construction located in central Melbourne. This work was undertaken by a group of four workers, comprising a manager/director, a supervisor and two unskilled workers. This work provided the context for a range of SWMS, including: (i) safe work at heights, (ii) safe access and egress to site and (iii) safe use of ladders.

6.1.1 MANAGERS' VIEWS

The view of Organisation A's managers is based on an analysis of interviews held with three key informants, and one set of documents (see Table 19).

The key informants were middle-aged men, who had between nine and 40 years' experience in construction, and had worked for Organisation A for two-and-a-half to seven years. The four common themes that emerged at this level were that SWMS: (i) provided legal protection, (ii) involved a process and (iii) had a role in safety. There were mixed views about the types of work that required SWMS. The development of SWMS appears to be a bottom-up approach that involves subcontractors, supervisors and safety experts.

Table 19

Data Sources - Organisation A Managers

Informants	Position	Age	Education / Training	Exp. in Cons (years)	Length in Company (years)
PAR053	OHS Advisor	39	Trade Cert / Cert III, IV, Diploma OHS	12	2.5
PAR050	Construction Manager	XXXX	XXX	9	3
PAR061	Site Manager	53	Yr. 8	40	7
Documents					**Version / date**
	Company 'Contractor Induction Booklet				Feb 2011
	Company OH&S Site Audit Sheet				
	Completed OH&S Audit				19.3.2011

6.1.1.1 SWMS Provide Legal Protection

A common theme from Organisation A Managers is that SWMS provide legal protection. This view is clearly expressed in a written document that is issued to the subcontractors:

'… (SWMS) is a legal requirement of OH&S law…' (Contractor Induction Booklet, p. 8).

This legal requirement is certainly emphasized by managers, as is evidenced by the following excerpt:

'Well, obviously we've got regulatory requirements … and I think that's the main thrust of it, to try and make us compliant as a company as well. We're a principal contractor and we need to be able to cover off on that somehow to show that. We have some duty there, so we need to actually cover off on it, so that's another way of us assisting this trade. To actually give it out to them. So, definitely a regulatory requirement…'PAR053

For this informant, because the organisation is a principal contractor, having a SWMS assists them to comply with their duty of care requirements. Because they are a principal contractor, having a SWMS and making it available to those who are undertaking the work means they are able to meet their duty of care responsibilities. Another informant explained it in this way:

'…I find them as a way of being able to transfer liability from the principal contractor to other parties…shifting of liability' PAR050

For this informant, having a SWMS in place meant the organisation was able to transfer liability to others where possible. The informant spoke of a recent experience of an incident at one of his construction sites that had resulted in an intervention by the regulator. According to him, Organisation A was able to shift the liability for the incident back to the lead contractor, in this case a concreter:

'It had basically gone from a builder's point of view, from I'd done the paperwork, and then the liability went to the concreter for taking unnecessary works outside his scope. So now any of the liability that would have come to use from the Regulator has now gone straight across to the concreter…' PAR050

In this instance because the necessary 'paperwork' was in place, the informant was able to demonstrate that the concreter who had been subcontracted had done work outside the scope of works allocated, hence the liability for the incident lay with the concreter.

Another expressed the legal requirement in the following way:

'Well, I think one of the first documents that's requested after an incident and becoming more and more, is obviously the Safe Work Method Statement and … more and more the regulators are asking for the Safe Work Method Statement …. " So, it's in our best interests to try and get it there to alleviate some of that risk for us, transfer it, and alleviate it. Yeah, to minimise a Regulator conviction, I suppose'. PAR053

According to this informant, when incidents happen on worksites, regulators will ask for SWMS, so by having one he is able to 'transfer' any risks and minimise a conviction from the regulator. This approach is suggestive of a culture of risk transfer (Loosemore & Andonakis, 2007). For another informant, this legal responsibility is also about accountability on site:

'…everyone should be accountable for what they're doing, that's my avenue of safe work method statement'.PAR061.

He goes on to provide the following in support of this position:

'…It actually has to be abide by, it's got to be stated, it's law, it has to be done, and I think that's our biggest thing today is let's get it done, let's make everyone accountable for what they're actually working on…'PAR061

For this informant, SWMS are law, they have to be abided by, so they have to be undertaken by everyone who works on his site. Here, this view suggests that SWMS act as a form of control. Abiding by a SWMS for him is about accountability of the trades he deals with, which he can use to drive this accountability:

'Yep I can hold them to it. It's not a ransom I would say, it's their mistake, they got to be…and it's ours too, we got to make them accountable. If they move stuff or they touch stuff or they build stuff, stuff unsafe let's get into them, let's go straight back to their work method statements. They're signing them…'PAR061

As this informant argues, his means of ensuring accountability with SWMS involves holding the trades to what they have signed onto, through a form of 'oversighting' or supervision. The firm views here seek to suggest a high degree of inflexibility with regard to how the work is to be done.

6.1.1.2 SWMS Involve a Process

A second theme from Organisation A managers is that SWMS establish a process; an example of this is expressed by the following excerpt

'Well, I think they are quite good because they set the process.' PAR053

This manager goes on to illustrate how:

'… instead of willy- nilly turning up to a job and just going for it, but if there's a set process that guys can work through…. That it's actually a quicker way to do it by these devised processes. It's a good thing especially if you've got an apprentice or someone like that. If you can get them to sign into a document that sets out their job steps it's going to dramatically reduce an incident but it's also going to streamline their job process, and get them in and out of the job, I think more effectively, because they've got some process to the job instead of stop, think, "What have I got to do now," but, if they've actually gone through some sort of process before they've actually started or whatever, for each individual job task, I think there is a bit of merit to it. I do believe there is.' PAR053

According to this informant, the SWMS process enables the job to be done more quickly, especially by apprentices, as well as streamlining the job. Having a SWMS means workers engaged to do a construction job do not necessarily have to stop and think about what is to be done next. This view would suggest that SWMS are about driving efficiencies on the job so that people don't have to think about the job. Indirectly, this is about controlling how the work is expected to be done. He goes on to illustrate this further:

'It's giving them a process to work towards, work through, and just make them realise too. These people do these tasks from day to day; they get a bit blasé about what can actually happen to them. What are you actually doing? Think about what you're actually tackling right now, what's going to happen to you if you fall off there, if you hit the nail gun and drop it through your knee? What's the ramification here? These guys, they do it day in, day out, I think they just turn off to the actual hazard after a while and it's not going to happen to me, mentality, which is always an issue but if we don't have a process, that road is going to be pretty rocky and unknown. At least if there is some sort of structure to it, it's going to at least head them down the right path'. PAR053

According to the above informant, because the contractors are doing the same work every day, there may be a tendency among them to become lax about safety. Having a process in place encourages a rethink of what is to be done; this includes a consideration of what could go wrong.

6.1.1.3 SWMS Have a Role in Safety

A third view that emerged is that SWMS have some role in safety, which the informants described in the following way:

'Obviously it's to ensure the safety of the guys on site as well. That's a primary function of it from that point of view…". PAR050

'…If you can get them to sign into a document that sets out their job steps it's going to dramatically reduce an incident…'.PAR053

'…it's to keep people safe and to prevent them from completing activities in the incorrect manner that could possibly increase their risk of personal injury…'.PAR060

One of the informants suggested SWMS primary function was to do with safety, and this was expected to come about from preventing people working incorrectly; that is, by ensuring people 'work to rule' by giving them a sequence to follow, safety will be achieved. This is tantamount to action rules (Hale & Swuste, 1998).

Another informant expressed the link between SWMS and safety in the following way:

"safe work method statements to me everyone should go home every day, make sure your jobs are clean, handrails especially on roofing, bricklayers should all have kickboards, handrails, scaffolds shouldn't be touched after completion, and completion of sign off…make sure everyone wears protection on their site, sign in books, make sure they sign in every day, every night. Make sure the boys are aware of their safe work method statements. Biggest thing I think with all the OH&S is just make sure everyone goes home every night, that my biggest thing…" PAR061

For the above informant SWMS act as a guide to working safely, and making this happen involves him personally ensuring a number of basic safety checks that he does as part of his job. In the main, this is about a reinforcement of basic safety rules on the job, including safety gear and completing the paperwork. What appears to be important to this informant is that SWMS are very much part of what he does.

6.1.1.4 Work Contexts for SWMS

There appear to be two different positions on the types of work for which SWMS are required. One view is that only some construction works require SWMS:

'If you are doing any of the following tasks then a Safe Work Method Statement is required:

- *where there is a risk of a person falling more than two metres*
- *involving demolition*
- *removal or disturbance of asbestos*
- *structural alteration that require temporary support*
- *confined spaces*
- *trench or shaft if excavated depth is greater than 1.5 metres*
- *near mains pressure gas*
- *energised electrical installations or services*
- *adjacent to roadways or railway*
- *movement of mobile plant*
- *extremes of temperature'* (DOC036 p. 8).

According to this view, 11 key types of construction activities require SWMS in this organisation. The list reflects those that have been identified as 'high risk work' by the government and 'DHRW' by the regulator. This view resonated with least one manager:

'Well, obviously we've got regulatory requirements to make sure we've got it for all high risk works'. PAR053

However, there is another view that suggests that SWMS are required for all construction work. This view is supported by the fact that Organisation A had in excess of 80 'generic' SWMS[26] available for use on their work sites, and these were expected to cover over 95 per cent of the construction works that were undertaken by Organisation A:

[26] Generic SWMS are samples/copies of SWMS that is usually produced by associations and/or safety consultants and maintained on their websites. They can be adapted for use.

'…So you'd almost say that our generic Safe Work Method Statements that we have would apply to 95% of the works that we do'. PAR050

Having a large number of SWMS means that some works will be the subject of multiple SWMS. The following serves to illustrate this very point:

"…I've come here to install fascia and gutter today…In my mind, a safe work method statement for high risk work, should be that specific task, installing fascia and gutter and the job steps that it takes to do that. That's it. And there might be another one for rough-in of plumbing internal in a house. That would be another safe work method statement…"PAR053

For the above informant, the activity of installation of a fascia and gutter would be the subject of two SWMS, one for the installation and one for the associated work of rough-in plumbing.

6.1.1.5 Anecdotes from the Field

One work that I observed being undertaken on this site, roof plumbing, was the subject of multiple SWMS. These included: (i) roof sheeting (ii) working at heights greater than 2 metres and (iii) working off ladders. The first of these was from the trades themselves, while the next two were provided by Organisation A. This may provide some support to the assertions that a work activity can be the subject of multiple SWMS, and that SWMS are required for all construction activities, not some.

6.1.1.6 Reflection-on-Process

In terms of how the SWMS 'documents' are processed, the organisation has a combination of those that it has developed in-house and those that have been adapted from the clients and/or customers. The way SWMS are developed at the level of management here is explained in the following excerpt:

'…basically the supervisors have a request on an audit form, to ask for Safe Work Method Statements as a part of high risk works, and they're required to ask and help identify the trades that don't have them. Once they're asking those sort of questions and getting the answers back we've actually developed, there's probably 80 Safe Work Method Statements that do general tasks through residential construction'. PAR053

So supervisors are involved in identifying SWMS for high risk work, and where one is available this is 'picked up' by Organisation A. In some ways, this appears to be a bottom-up approach to SWMS development, and has resulted in over 80 'generic' SWMS available for use throughout the organisation.

Managers do have an expectation that the trades they have subcontracted are capable of writing one out, and they encourage this whenever possible. The following excerpt serves to illustrate this point:

'Most of the guys here we write them out, every person has to be inducted here, every person that's not on site or hasn't been on site should be inducted into our inducting room, we explain the situation to them, what it means, what we have to do and make sure they follow the SWMS. I think it's a necessity they have to do '. PAR061.

However, Organisation A controls the development and deployment in terms of both the format and what needs to be included in the document:

'… we've decided that we will write them and also be in control of how they're written, as in the detail and the level of detail and the kind of wording, than rely on the trade to write it out, because I've seen a few from the trades and their not covering off on some major hazards because their hazard identification skills aren't there. At least if we're giving them a document, we're also training them and informing them, and this is probably how it should look without going overboard, because Safe Work Method Statement can be 20 million pages, and I think we've got to cut to the chase'. PAR053.

The above provides a rationale for how and why Organisation A exercises control over the development and deployment of SWMS. In essence, they realise that the trades may not necessarily have the skills to identify hazards associated with the works they are undertaking, so the SWMS document is used to train and inform the trades, even if these have been generated by the trades themselves. So indirectly, SWMS acts as a tool for informing and training subcontractors on the work they are undertaking. In addition, by taking control of the development of SWMS, Organisation A appears to be able to exercise control over one aspect of the 'quality' aspects: how many pages a SWMS has.

In reflecting on the process that is followed in the development and roll-out of SWMS in Organisation A, guidance issued by the state safety regulator is drawn upon*:*

'Just from guidance notes. Bits and pieces. I mean, obviously [Regulator] is a crucial part of my job and their information on their website is crucial to try and implement them back into the Safe Work Method Statement'. PAR053

The aim is to include information that the regulator has suggested is important for the industry; however, this information may not necessarily cover all trades, hazards, or risks. This means the organisation has to look elsewhere. One place that is looked at is the subcontractors (as discussed above); the other is customers:

'…Then also we're getting a few Safe Work Method Statements from companies which then I can upgrade mine and use bits of theirs and stuff like that, and that's what I do as well'. PAR053

Thus, information from customers is used to further develop the generic SWMS that have been created by Organisation A. This option is preferred because the expertise in the trade lies with the customer.

Earlier on, it was discussed that the position taken by Organisation A is that SWMS needed to be revised, and that the person in control of building or undertaking (PCBU)[27] had a role in changing the SWMS as necessary. In effect, this means the responsibility for revising and changing at least 5 per cent of the SWMS is expected to lie with the trades. However, it is not really clear the extent to which this actually occurs. What is clear is that management of Organisation A rely a lot on OHS expertise in making any changes:

'Any of the ones that we have that are above and beyond a normal SWMS, we would then be having—(OHS advisor) to site visit, and also then adapt, or look at a method of being able to minimise the risk'. PAR050

According to the above excerpt, the responsibility for adapting an existing SWMS or developing a new one altogether largely lies with the OHS expert. The final outcome is also in the hands of the OHS experts:

'Now, whether that be he re-orientates a SWMS, or maintains our original one, and he implements a new structure, a new method of being able to complete the task. If it's something, for example, scaffolding, we have to get someone out there around the scaffolding area, or areas where it's going over, or anything like that we need to be able to implement, the OHS advisor has to come out and have a look at it, and then once he's been out and had a look at it, and everything like that, that way we can actually proceed and say, "Well this is the best option we've got"'. PAR050

The above serves to illustrate that direct interaction between those holding expertise in health and safety and those in charge of managing the construction works plays an important part in processing any changes to existing SWMS. The opportunity to discuss and arrive at the best approach that is available does suggest managers may have a say in the revisions. However, this could be devolution of responsibility in as far as management of safety is concerned, particularly where 'rules' are concerned.

27 PCB refers to 'person in control of the business or undertaking' and is mentioned in the harmonised Work Health and Safety Act 2010; the equivalent in Victorian law is the Employer and/or Principal Contractor.

6.1.1.7 Summary

The previous section discussed the findings of managers in Organisation A, which are summarised in Figure 14.

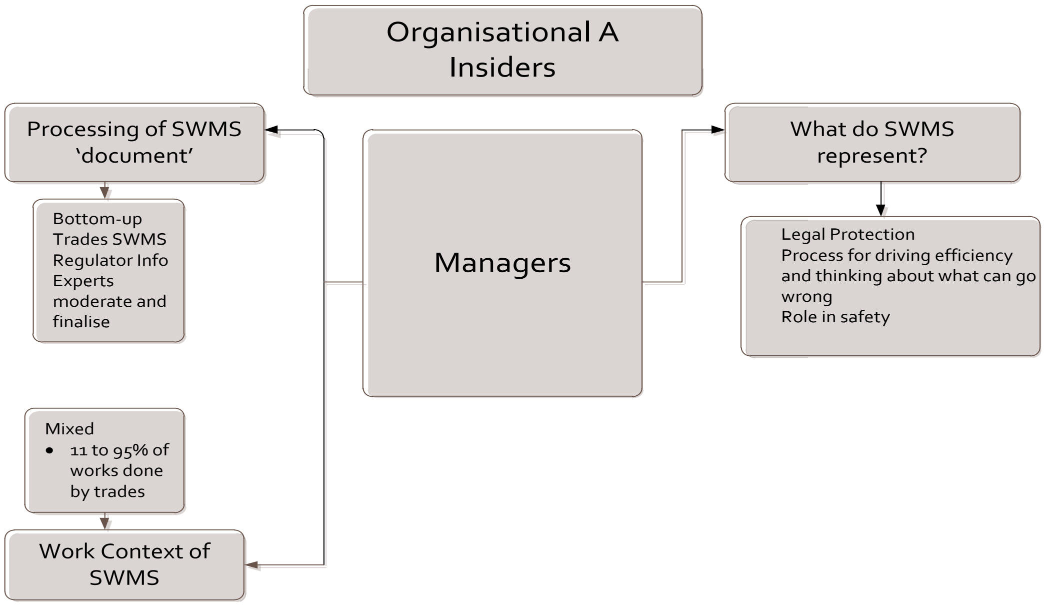

Figure 14: A Summary of Organisation A Managers' Views

6.1.1.8 Comparisons with Organisational Outsiders

In terms of what SWMS mean, the views of managers in this organisation are completely different to those held by the government/regulator. For example, while the government and regulator see SWMS as a safe system of work, a live strategy for controlling risks for DHRW, a cognitive artefact for planning and organising work, and a tool for social interactions, managers here see SWMS as providing legal protection, and as a process that is aimed at achieving efficiency of work.

However, managers here have views that are very similar to the association's in the sense that SWMS were a form of control and relevant to all types of construction work. The findings here suggest that managers appear to be more influenced by the association compared to the government/regulator.

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6.1.2 SUPERVISORS' VIEWS

The perspectives of Organisation A supervisors is based on an analysis of interviews held with seven key informants whose profiles are shown in Table 20.

Table 20

Profile of Organisation A Supervisors

Participant	Position	Age	Education / Training	Exp. in Cons (years)	Length in Company (years)
PAR056	Supervisor	34	Yr. 12 / TAFE	8	8
PAR057	Supervisor	34	Yr. 10 / TAFE	10	10
PAR060	Site Administrator	30	B	0.5	0.5
PAR051	Building Supervisor	XXXX	XXX	15	2.5
PAR052	Building Supervisor	XXXX	XXX	17	0.5
PAR054	Building Supervisor	24	TAFE	10	1
PAR055	Building Supervisor	45	TAFE	14	1.5

Most of these were middle-aged men who had experience in construction ranging from eight to 17 years, and between five-and-a-half to 10 years with the current organisation.

The main themes that emerged from the supervisors were that SWMS: (i) provided legal protection and (ii) had a role to play in safety. They would generally pay more attention to some SWMS (instead of all) and were involved in revising SWMS. However, these revisions did not necessarily mean changes to work practices. Supervisors are involved in undertaking site audits; however, these are mostly aimed at fixing the 'paperwork'. Some supervisors also sacrificed safety to achieve timely construction.

6.1.2.1 SWMS Provide Legal Protection

For some supervisors, SWMS are about providing legal protection:

'…it's an #%% covering exercise. It's done to make sure if something goes wrong, and (regulator) kick up a stink about it, everyone's covered. And that's really the reason why'. PAR051

He goes on to argue:

'Well, as supervisors we have to show that our duty of care is supervision, effective supervision. And that would be providing them with a safe workplace, and then from there giving them a scope of works and a workplace that enables them to follow through on that SWMS'. PAR051

Here the informant is suggesting that, at the risk of being litigated against if an accident were to occur, ensuring the trades had a SWMS meant he was meeting his duty of care. He shared a recent experience of SWMS and how it helped him achieve legal protection:

'We had a situation… it was three or four weeks ago where a similar operation was undertaken where they had to cut through a slab and dig a hole, and there was an accident, and the first thing [the regulator] asked was, what SWMS, what paperwork did you have in place, what scope of works, were you up-to-date? And yes, they were, and therefore, they showed adequate supervision, and they were seen to be working safely. And it was only that they went outside the scope of works that the accident happened. So it's very important. And that highlighted to me the need–to be honest, if that hadn't have happened, and it being fresh in my mine, it's quite possible I wouldn't have been as bullish about my SWMS yesterday". PAR051

According to the informant, an accident had resulted when cutting through a concrete slab and digging a hole and SWMS was one of the first things the regulator had asked for. Because of that particular encounter and experience, he had made sure that his most recent work had all the necessary paperwork, and that this was more site-specific. In contrast, on other occasions he had done similar jobs, he had not paid much attention to the paperwork.

Another informant provides a link between SWMS and legal protection in the following way:

'They've [the Principal contractor] got to make sure no-one gets hurt on a job because the fines…if we do something stupid that's not written on it, if we go out of the park on it, then we'll get fined as well as someone gets hurt, then the builder, he'll get fined because he's the one running the job. So mate, anything now it doesn't affect just the person that it happens to. Everyone gets affected by it, so it's real serious and everything has got to be done by the book and if something goes wrong everyone is in big trouble'. PAR056

According to this informant, the principal contractor has to make sure nobody was injured, and having something written was a way of making this happen. Moreover, if he (and other subcontractors) did not follow what was written and someone was injured, the principal contractor was likely to get fined and this could filter down the line. This, in turn, meant he was likely to be affected as well.

6.1.2.2 SWMS Have a Role in Safety

Another view of the supervisors of Organisation A is that SWMS play a role in doing work safely, as one of these informants suggests:

'The secondary and the flow on effect, which is quite a good one for myself and for the contractors involved, is that it causes you to stop and think about the OH&S side of it. It actually – it causes you to stop and make sure that it is a safe place. That you are doing it in a safe manner'. PAR051

For this informant SWMS played a secondary role in safety in that it caused one to stop and think about the health and safety aspects of the work. In essence this represents a form of 'reflection-in-action' suggested by Nathanael and Marmaras (2008a, 2008b). The informant goes on to suggest the following:

'I think the more—the reality is that what it does is it sets safety and the importance of safety in this operation in the forefront of their minds. If you have to stop and fill this out and talk about it, it actually sets the expectation that, yes, we want to do this job, but it is really important that we do it safely. It actually brings that to mind and brings it to bear in the forefront of their minds, rather than it be a subsequent thought. The job needs to get done, however we do it, used to be the way we think. Just get the job done; if you get it done, then that's the main thing. However—everything else is a bonus. Whereas now, it's get it done safely, I think. And that brings it to bear, brings it to mind like a toolbox meeting wouldn't, on a union site or whatever. It just starts them off the right foot'. PAR051

'It sets parameters and guidelines and it gets it in the forefront of your mind rather than safety being the last thing thought of, it's first thing'. PAR051

There are in fact two points being made. One is that a SWMS brings the thinking about safety aspects of the job to the forefront, rather than something that is thought about towards the end. Without a SWMS in place, the tendency would be to think about completing the work; that is, meeting production performance. But with a SWMS in place, the thinking extends not only to completing the work, but to do it safely. In this way, SWMS act as a tool to assist in RIA about how the work will be performed safely.

The second point is that it sets the parameters and guidelines for completing the work safely. This is suggestive that SWMS somehow set the 'boundary for safe operations' (Cook & Rasmussen, 2005; Rasmussen, 1997), and working within these boundaries is expected to assist in achieving safety. This is made clear in the following manner:

'You follow that Safe Work Method Statement; there shouldn't be a problem'. PAR051

So for this informant, following SWMS should not be a problem in as far as achieving safety is concerned. This is tantamount to 'working to rule' (Hale & Borys, 2012a). Another informant linked safety and SWMS in the following manner:

'But it also dictates to the subcontractor how they should do it in a safe way'. PAR052

The use of the term 'dictates' is suggestive of enforced control and/or direction, thus it is suggested that SWMS acts as a source of control. For these supervisors, exerting this type of control by asking the trades to follow the SWMS will assist to bring about safety. This is tantamount to working to rule (Hale & Borys, 2012a). Others made their point this way:

'Basically, a written one will set out a game plan of how you should attack the job and then if you follow your JSA then above board everything should be safe'. PAR057

'It's to keep people safe and prevent them from completing activities in the correct manner that could possibly increase their risk of personal injury'. PAR060

For these informants, a written SWMS represents a JSA and lays out a way of working, and if they followed this they were most likely going to be safe, by encouraging completion of works in a correct manner. However, having a SWMS 'document' itself does not bring about safety; it is more important that the supervisors reinforce the rules with the trades. This is made clear in the following excerpts:

'Also that we are consistently reinforcing safety with them, whether it is making sure that their leads are tagged, or whether it be that they're wearing ear protection. Those are things that are in the SWMS, but we don't necessarily refer to our SWMS. They're just—it's a consistent thing'. PAR052

'Yeah, if you walk past someone and they're cutting something with a saw that doesn't have a guard on it, you just physically tell them that needs to be fixed, you can't use it. And if you see them again, well, then you go and give them a notice of improvement. You tend to just—a lot of what I do is you just verbally give them, I suppose, the knowledge and awareness as you see it happen'. PAR051

This reinforcement from the supervisors involves interacting socially with the trades as they conduct their normal audits and checks that look at things such as electrical safety, use of personal protection and guarding of equipment. These may not necessarily be part of the written SWMS itself, but is largely based on their experience as previous workers in the building and construction industry.

6.1.2.3 Work Contexts for SWMS

There is a general acknowledgement that all trades have to have SWMS; that is, SWMS are required for all jobs. This was made apparent from the following excerpts:

'Every contractor should have the SWMS on them at all times'. PAR051

'Yeah, for the general day-to-day work'. PAR052

In practice, however, supervisors pay more attention to some tasks compared to others, as is clear in the following excerpts:

'It's probably not something that we push very hard in the general day-to-day of our job'. PAR051

'It's really not something we push very strongly at this stage'. PAR051

The informant goes on to provide a justification of why this could happen:

'The day-to-day running, if you've got a painter working on site or you've got a carpenter hanging a door or whatever, I can count on one hand how many times in two-and-a-half years whether they've got a SWMS. It just doesn't happen'. PAR051

According to him, SWMS were generally not common for normal, everyday works such as painting or carpenters installing doors. While they may be required to have SWMS for such jobs by their employer, it was more common not to have one. He goes on to suggest when they become more important:

'We really tend to focus on it more if we have high risk work, or work that's sort of very out of the ordinary'. PAR051

According to the above informant, SWMS for jobs that were deemed to be 'high risk' or 'out of the ordinary' would receive more attention compared to normal, everyday jobs. This finding is similar to Borys (2012), whose research site included a construction organisation, unlike the one here. He goes on to provide an example of what this entailed:

'For example, even just yesterday, I was having to dig down beside a slab and tunnel under. So for something like that it's not something we do very often, so I made sure all my SWMS were in place for that job'. PAR051

According to this informant, jobs such as digging beside a slab foundation, or where a tunnel was nearby, were part of this range because such jobs were not part of the day-to-day work. He would pay attention to the SWMS for such work.

Another example is when the sewer system has been damaged; a SWMS would be required, the main reason being that it is not something that is deemed ordinary.

'Another example might be, on some of the two storeys I've got, there's difficult access to a scaffold, for the roof tilers or the brickies, and there was going to be a difficult, not a standard lift up for them. That's the kind of thing that we would ask for, but it's the out of the ordinary things that we ask for'. PAR051

Similarly, if working on double-storey construction, the ease of access for putting up scaffolding would also dictate whether the work was out of the ordinary and whether a SWMS is required. According to another informant, having a SWMS became more important when work was being done on heights:

'Yes, that's a massive one. The safety aspect. Once you start going up in height, it's huge'. PAR056

Another informant provides an example of SWMS involving framing, which is one of the most common trades in construction:

'The most recent one was probably for framing here on this job and we covered off a number of SWMS for a new framer who came onto site and the framing SWMS covers up everything from erecting walls to erecting trusses, working at heights and we went over, well, for them to start work on the job they had to complete a number of safe work method statements prior to commencing'. PAR057

Thus, because framers were involved in doing a number of different tasks and activities, they would be required to complete a number of SWMS before they were able to commence work.

6.1.2.4 Revisions and Changes

Supervisors revising and making changes to SWMS are encouraged to make it specific to the site, and to the work being done. The following excerpts serve to illustrate how this is actually done.

'[The OHS advisor] has put them on our intranet, and we are able to access them at any stage'. PAR051

Having the SWMS on the intranet means these are accessible and can be downloaded and used. This informant explains the process he would follow in making these changes using an example involving excavation works:

'So the one I did yesterday was for excavation … which I went through with the company that was digging down beside the slab and tunnelling under to fix the drain. And obviously we went through the generalised items on his list that he provided for us, [the OHS advisor] provided, and then we added a couple of site-specific issues to that as well. There was some site-specific in that we were taking care not to undermine the next door neighbour's fence, taking care to properly discard of the effluent that was coming out of the pipe, that sort of thing. Which is not always the case with excavation. But it was due to that. So that was the one that we did yesterday'. PAR051

According to the above, revisions and changes involve going through a generalised list, or a 'generic SWMS', and adding in issues that are expected to be specific to the site. In the above, this involved making sure the neighbour's fence was not compromised and there was proper disposal of effluents from the pipes.

Another informant talked about how revisions to SWMS are handled in his company:

'We have specific SWMS for a variety of different tasks that are completed and then we also have a blank one that we use for anything that's outside of that box, anything that hasn't already been created, in which case we can write that up and identify those ourselves'. PAR060

The 'specific SWMS for variety of tasks' this person refers to are the generic SWMS that are expected to cover most of the activities that are to be carried out. However, they were also able to develop new ones if the activities were not included in the generic SWMS.

According to the supervisors, there were two instances when SWMS are expected to be revised:

'Now they are reviewed if there is an incident to see whether the [SWMS] has covered off, could have prevented that accident'. PAR060

'I suppose the other controlling factor would be regulations, when regulations change we need to review our SWMS, working at heights and working with scaffolding, that sort of thing. I can't think of anything major at the moment'. PAR060

So if there: (i) were an accident that involved a SWMS and (ii) changes in regulations, it was possible for the SWMS document to be revised. However, while the SWMS document itself may be changed, this is not necessarily followed by changes to work practices on site. The following excerpt serves to illustrate this point:

'To be honest there was nothing on that sheet,[28] *or that we put on that sheet that we didn't either already know the way to do that job, or the way we would have already done that job. But it reinforced to us that we needed to make sure we do it the correct way. There was nothing on there that we looked at and gone, oh, well, we better do that. There was nothing new to us on that sheet'. PAR051*

For the above informant, reviewing the SWMS did necessarily make him change the way he was working, but served to reinforced the need to follow the rules as laid out. He does acknowledge that SWMS got one to think about safety issues of the job. He goes on to provide examples of what this entailed on this particular job:

'It did make us make sure, like for example, first think I did I made sure I taped off the area. And that was because I'd been safety conscious, thinking of'. PAR051

This informant earlier suggested following the rules is expected to bring about safety. However, there is another reason why he may not necessarily change what he is doing:

'It was an experienced drainer who was doing the work, and he works in a safe manner. I'm an experienced supervisor and I work in a safe manner. So there was nothing on that sheet that guided us to do something differently to what we normally would have done'. PAR051

This supervisor has previously worked with the drainer, has seen him perform his work safely in the past, so he is relying on this as assurance that such performance in the past will continue. Moreover, by his measure he is a safe supervisor, so the written SWMS will not necessarily bring about any change to the way he worked or expected the supervisor to work. Inevitably, this has to do with trust (Burns, Mearns, & McGeorge, 2006; Schöbel, 2009; Taylor & Thomas, 2003) over paperwork, and it is trust from which safety will emerge, not the SWMS paperwork itself. Wadick (2008, 2010) notes a similar finding among

[28] 'That sheet' refers to the generic SWMS that is used in Organisation A.

subcontractors in the New South Wales construction industry, where workers trusted their previous experience instead of paperwork to get things done safely.

6.1.2.5 Monitoring of SWMS

In this organisation, supervisors play a role in monitoring the use of SWMS, with one informant explaining what this entailed:

> *'We, in general, are asked to ask them if they have a [SWMS] for their jobs and provide them with one or help them to achieve that if they haven't'. PAR051*

At a minimum, these involved asking the trades for a written document, giving them a generic copy from the organisation if they did not have one, or assisting them to get one. The effort by this supervisor appears to be getting the 'document' aspect of SWMS in place. I sought to understand what would happen if supervisors found the paperwork was not being followed. The following excerpt is a typical example of what was most likely to happen:

> *'We turn a blind eye to what we know goes on that is outside that scope that's just not possible to be … Like I said, if I see a guy working off a ladder, nailing something off, and he's doing it, he's not being a cowboy; he's just doing in the natural process of how it's done'. PAR051*

> *'Like he's standing on a ladder, the way you're supposed to'. PAR052*

> *'Yeah, but he's taking nails out as he's nailing it, he's doing whatever. As long as the ladder's a safe ladder, as long as the ladder's on a flat surface, as long as he's not like that or like that, I'm not even going to say anything. Because it's physically impossible'. PAR051*

According to the above excerpts, if these supervisors observe some of the rules not being followed, there is a tendency to accept the way work is being conducted, on the grounds that some of the rules stipulated can be 'impossible'.

However, a closer examination reveals that in arriving at the decision about whether the breaking of rules is acceptable, a form of secondary checking is also used. This is largely about an assurance that the ladder itself is structurally safe and is set up such that it is on a flat surface. In the minds of the supervisor, these are the things that will assist in achieving safety, hence the decision in allowing it to continue. This appears to be an example of lower-level sacrifices being made to achieve higher end goals (Cook & Nemeth, 2006; Nemeth et al., 2007). 'Working off a ladder' is generally discouraged as an industry practice because it requires the person using the ladder to adhere to the principles of three points of contact (Ellis, 2012; Health and Safety Executive, 2005; WorkSafe Victoria, 2005a). However, the supervisors attempt to assure safety through a form of secondary checks.

6.1.2.6 Sacrificing Against Safety

In the above section, it was revealed that supervisors did have a tendency to turn a blind eye to some of the rules if this meant achieving the goals of timely construction. This is suggestive that when balancing between production and safety, it is more likely that decisions made are more for production as opposed to safety. The following example serves to illustrate this point:

> *'For example, if you're a framing carpenter, the SWMS talk about working from heights and that sort of thing, and working off ladders, three points of contact. If you're working on a double story, for example, and you have to—you've got the walls up and you're walking up the ladder to nail off the trusses, you have to have three points of contact on the ladder as per the SWMS. You need two hands to do what you're doing. So quite … So whether or not—they're trying to be safety conscious, but they're not actually physically able to follow what the guidelines are'. PAR051*

According to this example, framing carpenters are frequently required to do work using a ladder, for say, nailing off trusses on a double-storey building. To do the nailing itself you need one hand to hold the nail and the other to hammer in the truss; this is the standard work practice for doing this part of the job. However, there is a rule that says there is need to maintain three points of contacts at all times,[29] and the supervisor believes that this is impossible to do with the above task.

From a safe work practice point of view, it appears that this particular rule is being wrongly applied. The guidance note on the safe use of ladders recommends that one should 'always have two hands free to climb up and down' (WorkSafe Victoria, 2005a, p. 4). In its strict application, this rule is about using ladders for access, ***not when working off or from a ladder***. The guidance note points to other requirements for prevention of falls from heights, and effectively discourages using ladder for doing works such as fixing trusses (WorkSafe Victoria, 2005b, 2005c, 2008a, 2008b, 2008c). However, because it is common standard practice to use ladders in construction, Organisation A's approach to this has been to suggest the subcontractors maintain three points of contact at all times. According to the goals-

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[29] This rule is stipulated in Organisation A's contractor induction booklet, p. 11.

means hierarchy, maintaining three points of contact is expected to be a high-order goal for this organisation (Cook & Nemeth, 2006; Cook et al., 2004); that is, satisfying the paperwork, and not necessarily doing the work safely. Indirectly, this encourages making sacrificial decisions in favour of efficiency and against safer work practices. The higher-order goal for supervisors is more about timely completion, and the rules regarding the three points of contact are likely to be seen as restricting timely completion, so the obvious stance taken is to bypass them whenever necessary.

The informant discusses another example where rules may not be fully followed:

'The sheet brace—it braces off the outside of the … It's physically impossible to do so in any manner that would comply with any safety order. Because you have to hang out of a job with a gun to shoot it off. There's no way that's safe, leaning out over an open window. It's not—there's nothing to cover that. You're most of the time, three metres, four metres in the air. You have to do it. There's no other way of doing it'. PAR051

In this case, the job requires the sheet to be fixed to the outside wall, and this supervisor believes there is no other way of doing it. In this case, a better and safer way of completing this job would be to use an engineering device such as a scaffold or an elevated work platform (Hughes & Ferret, 2007; WorkSafe Victoria, 2008c). However, this appears not to be used, for a number of reasons:

'Because the house would stop while you waited for a scaffold to get there'. PAR052

For this informant, the timely availability of a scaffold is one of the reasons why this does not happen.

'And also it's cost prohibitive. No one's going to put a scaffold just so you can put up a sheet brace. There's been a massive fight with framers over the years, even in regard to nailing the trusses up … Now, I mean, you're a framer, I was a framer, we always used to run around on the top plates. And still, a lot of them do these days. A lot of them will say if you're not prepared to pay for a scaffold for me, then I'm not wasting my time, because I get paid on a contract, to work off a ladder'. PAR051

The cost of getting a scaffold to put up sheet bracing is another reason why the work is done in the manner described. Because the subcontractors are not paid the costs of putting up a scaffold due to a culture of selecting the cheapest subcontractor, the work done will be based on cheaper methods.

Another case where the rules are frequently broken involves walking on top plates:

'Even now, they're not allowed to walk around on the outside top plates. They have to come one-point-five in[30] *and walk around the internal and do the outside off a ladder. Or have a platform'.* PAR051

'They know they're not allowed to be on the top plate, and the majority of times when you go there, you see them hop down. As soon as you drive, when you get back there in an hour's time, which have taken probably two hours if they had of done it the safe way, it's done'. PAR052

In the above case, the safety rules restrict walking on the top plates if they are in excess of 2 metres, and the company's approach has been to reduce this limit to 1.5 metres. Since even single-storey buildings will have a top plate that exceeds this height, a round-about way of implementing this is through height restrictions on the subcontractors, which the supervisors are expected to enforce. However, they still observe short-cuts being taken in terms of using the top plates to walk across, instead of getting down to the floor level and walking across to the area to be worked at. This practice has been a norm for many years:

'By the same token, there's a lot of guys that still do it the same way that I did it five, ten years ago, which is you just walk along the outside walls holding a truss. Just walk along, put the next one out, get the next one, and you walk up—you're five, six metres in the air, and you're walking on that wide, and you have no fall protection that way. It just happens, because that's the way it's always been and it's efficient'. PAR051

The point being made in the above excerpt is that it is more efficient to walk across the top plate if one is already working on it, rather than spend the time and effort to come down and go up and then go up again using a ladder. What is being suggested here is an example of how trades will work close to the margins of safe operating envelope (Cook & Rasmussen, 2005; Rasmussen, 1997); that is, walking on top plates at heights of up to 6 metres without adequate fall protection. In doing so they are trading off safety (getting down, walking across and going up a ladder, which is more safer) against production (getting the truss completed on time).

6.1.2.7 Summary

The above section discussed the findings of supervisors in Organisation A, the main findings of which are summarised in Figure 15.

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[30] This refers to a limitation of 1.5 metres from the concrete boundary.

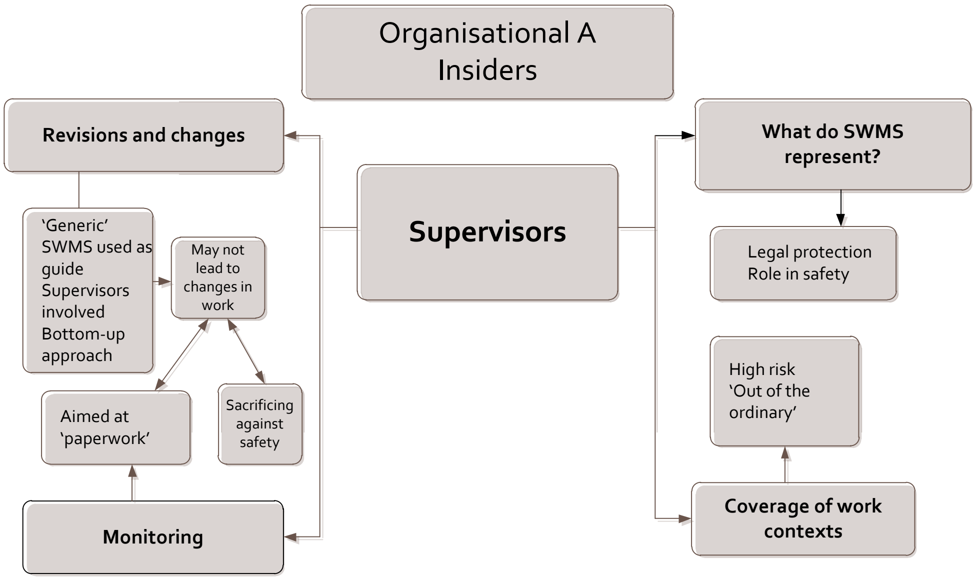

Figure 15: Summary of Organisation A Supervisors' Views

6.1.2.8 Comparisons within Site

The supervisors of this organisation have two views that appear to be common to the managers here, in that SWMS: (i) provide legal protection and (ii) have a role in safety. The view of SWMS as a process for achieving efficiency on the job held by the managers is not something that is shared by the supervisors here. While there is mixed understanding of types of jobs that require SWMS according to the managers, supervisors were more clear in the view that high risk or 'work out of the ordinary' SWMS were likely to be given more attention.

6.1.2.9 Comparisons with Organisational Outsiders

The supervisors of this organisation have some views that appear to be common to the government and regulator: that SWMS are required for some works only, and that they have a role in safety. With regard to the latter, some supervisors do believe it happens by following the rules or guidelines, while others believe safety comes about from constant reinforcement.

The government/regulator view that SWMS are a live strategy for risk control or a cognitive artefact for planning and organising, or a tool for social interaction, is not shared by the supervisors here.

Some of the supervisors' views that SWMS are required for all work and as a form of control are also similar to the associations. For supervisors, the control comes about by bringing safety at the forefront, setting the boundaries around undertaking the work safely, and rules for working safely.

6.1.3 WORKERS' VIEWS

The perspectives of Organisation A workers are based on an analysis of data from four key informants and a series of documents (see Table 21). Most of the informants were young men aged between 18 and 23, who had completed schooling to a level ranging from years 10 and 12. Two were employed as labourers and two as apprentices, one of whom was also a machine operator. The respondents' experiences ranged from three weeks to three years, all of which was with the current organisation.

The two common views that emerged at this level of analysis were that SWMS had a role in safety, with mixed views about work contexts that required SWMS.

6.1.3.1 SWMS Have a Role in Safety

Some of the workers surmised SWMS were about safety:

'To keep people safe, I guess'. PAR058

'Yeah, safe and safe work methods'. PAR059

The latter goes on to provide the following explanation:

'It's just like every builder has to read all the regulations that the SWMS have, the terms, and then they've got to abide by it so then they are safe by that worksite'. PAR059

According to the informant, it was up to the builders to read and understand the regulations and to follow them, and doing both of these was expected to make them safe on the worksite. The suggestion being made here is that safety is achieved by reading 'rules' and working according to the rules. However, as Bates and Holton III (2004) point out, many workers in the construction industry do not possess the required levels of literacy required to

Table 21

Data Sources - Organisation A Workers

Participant	Position	Age	Education/ Training	Exp. in Cons	Length in Company
PAR058	Labourer	23	Year 10	3 wks.	3 wks.
PAR059	Labourer	19	Year 12	3 wks.	3 wks.
PAR062	Apprentice Drainer	18	Year 11	1 wk.	1 wk.
PAR063	App. Plumber/ Machine Operator	23	VCE	3 yrs.	3 yrs.
Documents					Version / Date
Company SWMS – Working over 2 m in height on residential construction					SWMS004 5/1/2010
Company SWMS – Working off ladders					SWMS032 5/1/2010
Company guide to safe working practices					
Subcontractor job safety analysis – roof sheeting					22/10/2009
Subcontractor job safety analysis – Trenching and excavation					6/9/2011

read and comprehend procedures and texts provided to them. Moreover, workers working at the sharp end of the risk of construction work are generally not involved in the revisions and changes (Borys, 2012). Moreover, in this organisation there appears to be reluctance to change a SWMS once it has been written up. Thus, being able to rely on trades to read and do the work according to the 'rules' of the SWMS may not necessarily bring about safety by itself. If this is the case, how does safety actually come about on the job according to the workers?

Earlier in the findings about SWMS having a role to play in safety, supervisors here talked about the importance of engaging actively with the trades to ensure they followed the rules. At least one of the workers suggests that this happens:

'Either the supervisor or another supervisor, they tell us if we're doing something a little bit unsafe, they tell us that it's unsafe and they're obviously supervising us as well'. PAR059

For him, if there were things they were doing that are unsafe, the principal contractor's supervisor or his immediate supervisor would tell them so. He goes on to give an example of this:

'Well, scaffolding, we don't go up unless there is scaffolding, obviously. We have to make sure we're safe and if we feel unsafe we tell the supervisor or another[31] supervisor and then they will tell the supervisor of the actual construction company'. PAR059

Using an example, he suggests that if work were to be done at heights, they would not go up unless a scaffold was provided. Moreover, if he felt unsafe with the scaffold he would let any of the two supervisors know.

Another talked about safety and SWMS in the following way:

'Aware of what is going on'. PAR063

He believes this made him aware of what was going on.

6.1.3.2 Work Contexts for SWMS

There is an understanding among some workers that SWMS are required for some jobs, not all. For example,

'Because it's so high up'. PAR058

*'A roof so *0:03:36.3 metres above the ground, so it's more you've got to be safe at work'. PAR059*

According to these informants, because the work they were doing was high up[32], a SWMS was necessary.

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[31] The reference to two supervisors suggests the trades here interact with two different supervisors, one for the trades, and one from Organisation A.

[32] The task being undertaken here involved the installation of aluminium roof sheets on a two-storey housing construction project.

However, others suggest these were required for all jobs:

'Yeah, one is required for every job'. PAR062

'All jobs have a general one we use'. PAR063

'General SWMS for this particular job–drains'. PAR062

Thus, a job such as drains on a construction site was the subject of a SWMS.

6.1.3.3 Anecdotes from the Field

While in the field I observed a number of activities over a course of two site visits. These included roof plumbing at a medium-density (double-storey) unit and excavation and drains (plumbing) at a domestic (single-storey) site.

The roof plumbing works, illustrated in Figure 16, involved a team of four, one of whom was a manager, another an experienced tradesman and two apprentices. What stood out in these activities was the way the work for roof plumbing was executed. Working in pairs (an experienced and another trainee) the teams carried aluminium roof sheets measuring about 0.5 metres wide and 12 metres long over a distance of 6 metres across to the point of fixing. These were screwed on before the next sheet was placed, aligned and screwed on again.

From a discussion with the team, I felt a sense of 'coordination' between the crew became important. Moreover, a 'buddy system' of work whereby a less trained worker was partnered with a senior and more experienced worker ensured a smooth flow of work.

Over the course of the two hours I spent on the site, I observed some slight changes in weather conditions. There was a breeze, followed by a slight drizzle, and later the wind picked up speed. Apart from a cursory glance at the sky, the work continued without a break. However, on an adjacent site where similar works were going on involving a different set of workers and unrelated to this research site, I observed the three people who were doing similar works stopped and walked away when the wind picked up speed.

I noted that the SWMS and JSA used by the roof plumbers made no mention of changes in weather conditions as a hazard. According to the discussions I had with the subcontractors, changing weather conditions experienced were basically part of the norm; it was something they had learned to continue working with. The threats were not high enough to put them in any form of harm. Because they were experienced plumbers, they relied on their experience to decide if and when the job had to be abandoned.

Figure 16: Roof Plumbing Works on a Medium Density Construction

From a RE point of view, there was a regular threat in the form of changing weather conditions. This team dealt with this by continuing to go on with normal work, by 'taking things in their stride', and there was no need to sacrifice higher-order goals against an everyday threat (Cook & Nemeth, 2006).

Another activity I observed was the work of excavation and drains (plumbing) on a single-storey construction, illustrated in Figure 17. This work involved two people, one a more experienced drainer who was also an excavator operator, another apprentice drainer. What struck me with this activity was how close the apprentice stayed when the drains were being excavated: within an arm's reach of the bucket. For me, this was tantamount to 'working close to the edge'. At any time during the course of work, the apprentice could have been struck by the bucket, or have his feet crushed. Working so 'close to the vicinity of mobile plant' is generally at odds with the recommended guidelines for doing excavations safely. Excluding workers from areas of an excavator by bunting or fencing, a clearance of at least 0.5 metres between the any operating part of an excavator and persons, a high level of visibility and safe means of signalling between the excavator operator and any persons in the

Figure 17: Excavations and Drains on a Domestic Construction Site

vicinity are minimum requirements (Safe Work Australia, 2012). However, on this occasion, visibility and hand signalling between the two were used to manage the risks.

In this instant, there was a regular threat in the form of the apprentice working in close vicinity to the excavator where he would have been subjected to serious injuries from being stuck by the bucket or crushed by the excavator. However, the two workers continued work as normal by taking things in their stride (Cook & Nemeth, 2006).

An episode I observed that occurred during this activity involved the team's reactions to changing weather conditions, something these workers also encounter as part of their normal work. About an hour into work, I observed the winds picking up speed, followed by darkening of the skies. The workers glanced at these changing conditions, but continued working, with a subtle increase in pace. At the sign of the first drizzle I observed the excavator signalling 'thumbs down', a cue the resulted in his colleague moving to collect the boxes of PVA glues, joints and tapes for the job inside their ute. Within less than 20 minutes, it started pouring heavily, causing the workers to stop work and move inside their ute (an opportunity I used to complete my interviews).

The response repertoire used here represented to me a form of episodic adaptation (Grøtan, 2011; Grøtan et al., 2008) in 'a small packet of order' (Grøtan, 2011, p.102). This adaptation can be analysed through the REL model (Grøtan, 2011). By subtly paying attention to the changing weather conditions (*entry point*), the team developed an anticipation of the risks; this targeted *risk understanding*. The two-member team responded in an organised sequence, stopping part of the work they were engaged in first, before completing the work altogether, according to a *release chain*. By stopping work altogether, the workers responded to the threats they faced, even though there was no direct supervisor on site. For me, this episodic adaptation demonstrated a subtle form of resilience; with a continuance of trenching and drains sacrificed in favour of safety.

6.1.3.4 Summary

The views from four subcontracted workers in this organisation seeks to suggest SWMS had a role in safety by making them aware of what was going on, by abiding to it as a set of rules. Their understanding of work contexts for SWMS varied, from all works to some specific ones, including working at heights and for drains.

6.1.3.5 Comparisons within Site

The view that SWMS provide legal protection, or that they involve a process held by managers and supervisors of this organisation, is not something that is shared by the workers here.

However, the view that SWMS have a role in safety as a set of rules and the mixed view of types of work that require SWMS, are two of the common views shared by managers and workers in this organisation. The latter are also similar to supervisors and workers in this organisation.

6.1.3.6 Comparisons with Organisational Outsiders

The view held by workers that SWMS is about safety is something that appears to be common in some aspects to the government and regulator, for whom SWMS represented a method of working safely. Similarly, the view of some workers that SWMS are required for some construction works is something that is also common to the government and regulator. However, the views that SWMS are a live strategy for controlling risks, a cognitive artefact or a tool held by the government and regulator is not shared by the workers in this organisation.

The view that SWMS are required for all works held by the association appears to be shared by some workers in this organisation.

6.1.4 SUMMARY

This section discussed the findings of Organisation A insiders. The findings revealed that SWMS are expected to achieve different and multiple objectives at the three levels of this organisation. While there were some common threads between them, there were also a number of differences, both within the organisation and when compared to the organisational outsiders. The diverse views of the organisational outsiders and Residential Builder A are illustrated in Figure 18.

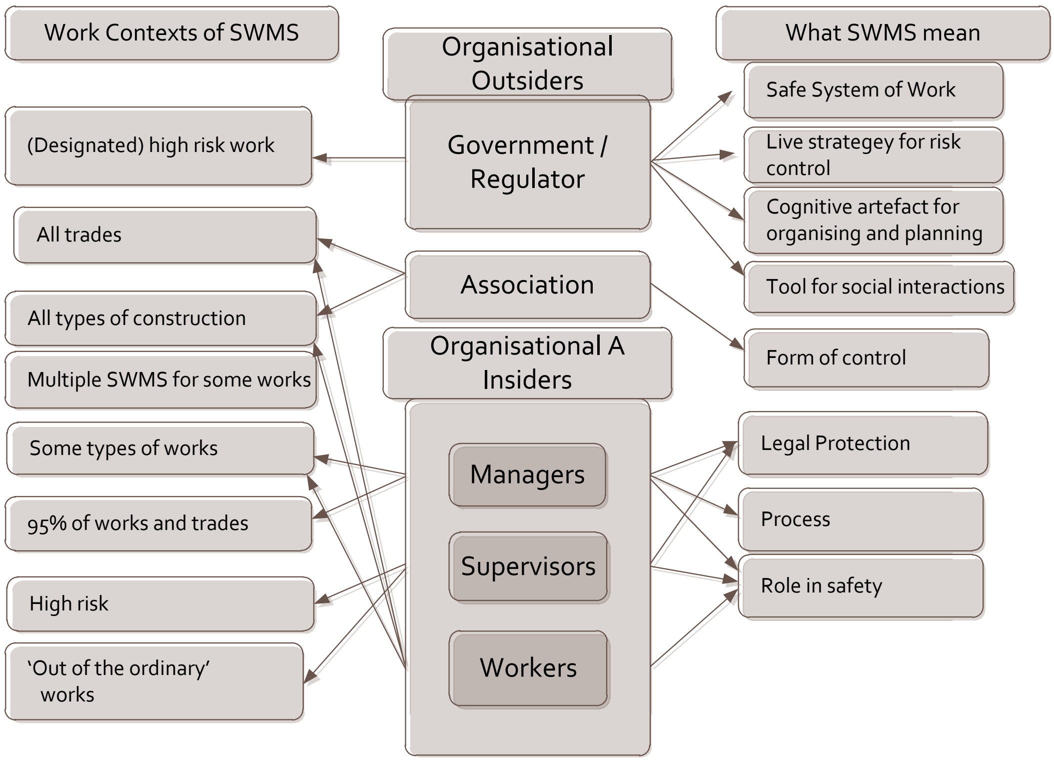

Figure 18: Summary of Organisational Outsiders and Residential Builder A

6.2 ORGANISATION B VIEWS

Organisation B is a residential building group that is also part of the VVHMSA. The company is one of Australia's high-profile integrated property development entities and a market leader in medium-density housing construction in the state of Victoria. Over the last three decades, it has developed from a small and strong building development company into a multi-award winning residential builder. It has over 20 display centres spread across Melbourne and regional Victoria. It also owns additional medium-density holdings in the states of Queensland and South Australia. In addition to this, it provides a portfolio of property-associated services spanning across financial services, plumbing, storage, technology and innovation, and aviation. The company directly employs construction managers, project managers and construction supervisors, with actual construction undertaken by pre-selected subcontractors from a wide range of trades. Similar to Organisation A, this organisation also has a dedicated health and safety function, but also manages the environmental responsibilities of the group. At the time data were collected, this function was managed by one person. It has an intranet-based safety management system, and SWMS are one element of this management system.

The three specific research sites at which data were collected in this organisation included a regional office and two medium-density construction projects located in south-western Victoria. The first included the company's head office located in the Western suburbs of Melbourne; this is where most of the managers and a number of supervisors were interviewed.

The second site involved a medium-density project located in the western suburbs. A number of different stages of work activities were involved in this research. One activity included the laying of foundations for a block of garages for a medium-density complex comprising eight new-constructed two and three bedroom flats. This work was done by a group of eight employees who had been engaged through a subcontractor. The range of work activities undertaken provided the context for a number of SWMS, including: (i) foundation work (ii) excavation (iii) mobile plant and (v) manual handling. Another activity at this site included the laying of roof tiles. This work was done by four people, two of who were joint partners and owners of a subcontracting business, and two labourers who had been employed by these subcontractors. The main SWMS that the activity was subject to included working at heights.

The third site was also a medium-density residential construction. One stage of works being done on this site included the laying of aluminium roofs on a newly constructed house that was part of a series of eight new units. The job was done by a group of three tradesmen, comprising a supervisor and two workers. This work provided the SWMS context for: (i) aluminium roofing and (ii) working at heights. Another stage of work that was being done at this site included roof tiling on an adjacent double-storey building. This work was done by another group of three subcontracted employees. This work provided the SWMS context for: (i) working at heights and (ii) roof tiling. A third activity involved framing work on the first level of a medium-storey building undertaken by another group of six employees, one of whom was a leading hand and five other employees who were in various stages of completing their apprenticeship. The SWMS context for this included: (i) timber framing and (ii) safe use of a ladder. The fourth key activity included the laying of brickworks on three sets of buildings by three separate subcontractors. One was a self-employed person, another worked with a group of two, and with a group of three. The SWMS context for this activity included: (i) bricklaying and (ii) working at heights. A fifth activity at this site included plumbing works on the first floor. This was done by one person who was employed by a subsidiary of Organisation B. This activity provided the context for SWMS associated with: (i) plumbing and (ii) working at heights.

6.2.1 MANAGERS' VIEWS

The prescription of Organisation B is based on an analysis of interviews held with three key informants, supplemented with an information circular of SWMS issued to the trades (see Table 22).

All informants were men aged between 43 to 48 years, and held TAFE qualifications. One had three years in the construction industry and two years with the current organisation, while the other had worked for 25 years in the construction industry and three years with the current organisation.

According to the informants, SWMS: (i) were a form of cognitive artefact, (ii) had a role in safety, (iii) was a tool and (iv) was applicable to all work. There was a defined process for the development and revision of SWMS.

Table 22

Data Sources—Organisation B Managers

Participant	Position	Age	Education/Training	Experience in Cons (yrs.)	Length in Company (yrs.)
PAR003	Construction Manager	XXX	XXX	30	1
PAR023	HSE Manager	48	TAFE Diploma	3	2
PAR025	Project Manager	43	TAFE Cert IV	25	3
Documents					Version / date
Safety Alert: Safe work method statements – What/Why/When/How?					Circular No.19

6.2.1.1 A Cognitive Artefact

A common theme from managers in Organisation B is that SWMS are a cognitive artefact, as expressed in the following excerpt:

'The documentation for me is purely worked the same as like a prompt sheet to assist people to, I suppose, think through the process, identify hazards and risks and it is very much a prompt, it serves as a prompt sheet for someone. It is like if I ask you to walk into a room and say, "Hey, let's have a look at some hazards". In an unfamiliar environment, even if it is a familiar environment, sometimes without some guidance or getting your mind working again in that framework, it can be difficult just to get that thinking working, so Safe Work Methods Statement has the advantage'. PAR023

For him, SWMS acts like a prompt sheet for identifying the hazards of doing work in both familiar and unfamiliar environments. Most trades will be familiar with hazards and threats they encounter as part of normal everyday work—this is an environment they know, and SWMS are expected to, therefore, bring to the fore regular threats (Westrum, 2006). However, in an unfamiliar environment, SWMS are expected to bring to the fore irregular (Westrum, 2006), perhaps unexampled, threats (Epstein, 2008), hence acts to amplify the thinking about hazards and risks. By amplifying this ability, it acts as a cognitive artefact (Johnsen & Nemeth, 2005; Norman, 1991). The net effect of this is to help people think about the work at hand, of the possible effects and challenges of the job. He goes on to explain the following:

'The key is get them to think about the task and if we have got a prompt sheet that can assist them in that process'. PAR023

'When you are looking at your work environment, "What is the impact, what are the challenges that you may face?" If you can sort of try and address or identify what potentially can hurt you or someone else, what potentially can have an impact on the way that we operate … ? If we just step back and consider that before we start the job and think about "Well, what are my options? … What is the potential impact to me and my team?" Weighing that up and go "Hey, yes we're safe, we are ready to go." Or, "Hang on, I have seen something here that I am really not comfortable with, and I am not willing to expose myself or my people to that, well let's then deal with it"'. PAR023

In talking about the different types of hazards, the above informant is referring to a template used that lists a series of hazards and that can be ticked off as people go through the checklist. The initial focus is expected to be on regular and 'normal hazards' of the work. However, as the excerpt suggests, the checklist also enables one to engage with the thinking process at a much deeper level. This amplifies the thinking about potential threats beyond the surrounds of the immediate work, so acts as a cognitive artefact.

6.2.1.2 SWMS are a Tool

Another view that is common to the managers is that SWMS is a tool, as was evident in recent circular issued to all its subcontractors and construction staff:

'Put simply, a SWMS is a prompt sheet that aids discussions within your team—or, if you are on your own, helps you to think about and visualise the task ahead by:

• *planning the task (working through each step/phase)*

• *identifying the hazards that may be present or potential risks that may occur during the activity*

• *providing a resource to document the control measures that will adequately manage these hazards and risks'.* (Company SWMS document)

According to this view, SWMS then seeks to achieve multiple objectives. One, that it is a tool for discussion. Two, it is a tool for: (i) planning the construction task that the subcontractor, on his or her own or as part of a team, will be performing, (ii) identifying hazards and risks for work and (iii) a place for documenting the control measures for managing the hazards and risks. Another view expressed in the issued document suggests:

'Completion of a SWMS assists in planning, identification, and control of hazards and risks to ensure that the site is safely managed at all times'. (Company SWMS document)

According to this view, SWMS is essentially a planning tool for the conduct of work. In this organisation, this planning appears to be associated with the 'conceptual stage' of the life-cycle of construction projects (Swuste et al. 2012). The focus of hazards at this stage is likely to be those that are given as examples (Epstein, 2008) or the normal, anticipated hazards of the work at hand. As a document, SWMS also acts as a tool, as expressed in the following excerpt:

'The document is a tool, is purely a tool for the practical implementation'. PAR023

'It also serves as an audit tool as well and that is probably where for me, for the most part, what the Safe Work Methods Statement as a document sits'. PAR023

The document that is produced can also be used as a tool to help with the processing aspects of the job, and as an audit tool to monitor the work being undertaken. The latter can also be used for controlling how things happen on site through enforcement:

'I enforce the SWMS on all trades when they start a job'. PAR025

As a tool, SWMS is also used to create awareness within the trades, according to one informant:

'Awareness, obviously safety on a day-to-day basis to all employees, all employees and people on site and also it's a form of identifying problems that may reoccur on a regular basis'. PAR003

In the above case, the informant suggests the form itself is useful in creating awareness and in identifying potential problems; the reference to recurrence on a regular basis seeks to suggest the concern is with regular and exampled threats (Epstein, 2008).

6.2.1.3 SWMS Have a Role in Safety

The above discussion suggested that SWMS involved a process that assisted trades to think about and plan the work, hazards and risks, and document the hazard control measures. Hence, it is indirectly about safety. However, there is an acknowledgement that the paperwork, by itself, does not necessarily bring about safety:

'I have never seen a document stop someone getting hurt. So the other key component of completing the Safe Work Methods Statements is, I suppose, its practical implementation, and it really sits around the discussion, the discussion you have with your team. If you are working in a team it is a discussion that you have with other people or people on site, whether people on trades, it is that communication, so it is that physical interaction. That is what stops people getting hurt because they are actually now connecting'. PAR023.

For him, implementing SWMS was equally important as filling in the paperwork. This largely depended on the discussion one has on site, the physical interactions that occur with the people who are undertaking the work, and it was the SWMS that connected the work and those doing the work. He passionately goes on to describe how this interaction actually goes on:

'We will have a bit of a discussion of the scope of activities that they actually currently undertake and that would include all of the different types of environments, the different types of constructions and all of that sort of stuff … what is the scope that we want to cover off? Then we might break that down into looking at each one of those different aspects of different types of jobs or environments that they work in—can we get a set of steps that will actually link down or their approach of how they would go about that task. We would probably just list all of that down. Then we will discuss each one of those and there is always a bit of toing and froing and challenging because it is important to challenge the process and broaden the thinking. We will go through that and we will talk about "What are the risks? What are you exposed to and where potentially can you get hurt or look at your incident rate? Let's go back and discuss what type of injuries you have had in the business and why, when did we draw those and what are the causal factors of those types of incidents". So we sort of have that type of discussion. That then helps us identify the hazards and the risks because we have got some tangible evidence to support that. Then once we have identified that, then we will discuss the control measures and we work through the hierarchy control'. PAR023

According to the above excerpt, the discussion that occurs involves breaking down the job into steps, identifying hazards and risks of the different steps, looking at means of controlling the hazards and risks, and some form of review across the process itself. In identifying hazards and risks, the discussions involve a consideration of the physical environment where work is to be done, as well as experiences from the past; that is, trying to learn from previous incidents, which provides the evidence base for the hierarchy of controls. For him, these discussions with the trades are an important part of the process because he believes it is through these discussions that the trades are making connections between the work and the process of SWMS.

6.2.1.4 Work Contexts for SWMS

According to Organisation B, SWMS are required from all trades, as suggested by the following:

'Recently Org B has amended its policy to ensure that all trades must complete a SWMS prior to the commencement of work'. PAR023

According to this informant, SWMS were previously not required for all construction works, but a recent policy change meant these were now required for all such works. He reinforces this in the following way:

'Every contractor … every contractor who works for [Organisation B] must complete a SWMS—must'. PAR023

The use of 'must' seems to suggest completing the paperwork is very important, a view that is also sounded by other informants as well:

'I enforce the SWMS on all trades'. PAR025

This reinforces the understanding that SWMS are required for all construction works and all trades. If this is accepted, the practical problem for supervisors, especially those who are subcontractors, will be in trying to decode which was more important: completing the paperwork or trying to complete the work safely (Hale & Borys, 2012a, 2012b). The thinking by some managers would seem to suggest completing the paperwork was a high-order goal (Cook & Nemeth, 2006). However, one manager suggested this might not be the case:

'We are obviously promoting to have our trades supply SWMS for each job that they do on site, each contract, each subcontractor'. PAR003

In the above excerpt, the use of 'promoting' instead of 'enforce' and/or 'must' suggests a desired position of subcontractors completing and supplying SWMS for each of their jobs; hence, completing the paperwork becomes a lower-order goal (Cook & Nemeth, 2006). Here, achieving safe construction becomes more important, so it is possible completing the paperwork can be bypassed should the need for this arise.

6.2.1.5 Reflection-on-process

There is an explicit requirement in Organisation B about how and when SWMS are required to be written up, before starting the job and when moving to another job:

'A SWMS must be completed:

• *prior to the commencement of work on each site (weekends included)*

• *if you move to another site'.* (Safety Alert)

Organisation B also makes explicit how one goes about developing a SWMS:

'Upon arriving at the job site just before setting up, the team leader should have a quick look around while one of the competent team members check the equipment and setup. Once this is complete, bring your team together to complete the SWMS'. (DOCO44)

In this organisation, SWMS are expected to be done before the work actually commences. Informants explained where SWMS fitted in and when they were required:

'Before they start the job say when they come to site before they actually set up … It is very much before they set on the site'. PAR023

Earlier on, I have suggested that the SWMS appear to have developed at the 'conceptual' stage of the life-cycle of the construction work. However, what appears to be happening is that the SWMS developed earlier are now forming part of the construction cycle. This provides an opportunity for the team to have a look at the site, the environment and the equipment. An informant then goes on to suggest how this is expected to actually occur:

'The team leader needs to do a bit of a walk of the site and inspection and so a competent person within the team can start to look at the equipment or do the equipment checks while that is being done then they come back and as a group of people, they discuss the site. Now, our sites are quite small from a detached perspective, and so that they can have a quick look around and identify what needs to be done so they can complete their SWMS together as a team or if someone completes it well then it is reviewed'. PAR023.

The process discussed above is tantamount to a pre-inspection of the worksite. And because the site itself is not very large, it is expected this can be done within the time allocated. According to Organisation B, the development of a SWMS is a team activity. They also provide a step by step guide to what is actually involved in the development of a SWMS:

(1) 'Write down each step in the task commencing with the toolbox talk "team discussion", set out, environment check including other personnel check and so forth.

(2) Discuss with your team any hazards or potential risks and list these against each step.

(3) Discuss appropriate control measures that will manage identified hazards and risks, and ensure that all works are completed in accordance with the control measures.

If control measures require modification due to improved process or situational change, communicate this to your team and update the SWMS'. (DOC 044)

The development of SWMS is expected to start off with a toolbox talk, setting out of work, a check of the environment and people, a discussion among the team about any potential hazards or risks, the risk control measures to be used, and a reinforcement of the message that works have to be completed in accordance with the control measures. The checking in this case is most likely to be directed at regular threats (Westrum, 2006). However, it is possible that the interaction among the team may also reveal some irregular, even unexampled threats (Epstein, 2008; Westrum, 2006). The interaction is expected to consider ways of managing these hazards; this suggests there is an opportunity to reflect in action (Back et al., 2007; Nathanael & Marmaras, 2008a, 2008b).

It has been suggested above that SWMS should be revised and changed as the work progresses. However, it appears that this does not actually occur, as evidenced from the following:

'It shouldn't come back like that. It shouldn't come back like that because it is a document that can be used on every site. When you have materials, you have other people on site, you have weather conditions, there is no reason why a SWMS should come back'. PAR003

Using further probes to identify what actually happened if the working environment changed from job to job, for example, if there were restricted access, what would happen to the SWMS process revealed the following:

'We can obviously get pre-deliveries made and we do it quite often if there's restricted blocks that we can't get into, we'll deliver bricks and roof tiles to the rear of the house or to the site, wherever it may be, restricted deliveries, so if you've got six thousand bricks that you need to finish the house with, you might only get deliveries of two thousand bricks at a time and that is not a cost to the company, from the brick company, because they will deliver without any cost, even if we split them'. PAR003

This informant suggests altering of the work practice would be a way of dealing with restricted access. This involves re-planning, reorganising and rescheduling the delivery times:

'This could be done on a daily—it would have to be done on a day-to-day basis as well because the sites change on a daily basis'. PAR003

However, these are all treated as part of normal work, because the managers expect such changes as the site changes on a daily basis. While the work is being reorganised and re-planned, the document itself may not necessarily be changed, as suggested by the following excerpt:

'There wouldn't be a great deal, but keeping in mind there shouldn't be a great deal because all the preplanning should have been done prior. In other words, bricks at the back, tiles, roof tiles at the rear, tank delivered if it need be'. PAR003

One possible reason why the SWMS are not actually changed appears to be because most of these are from Organisation B itself. This was made clear from a number of informants.

'I actually suggest to all supervisors to have copies so they can actually help them out and help them create one'. PAR003

'Ahm … most of the SWMS we encounter are mostly our SWMS'. PAR025

Thus, managers find it much easier to give out a copy of Organisation B's SWMS to its trades because of their prior experience with trades who appear not to be able to do them on their own.

If this is indeed the case, then a possible question can be asked: is the process of developing a SWMS robust enough? Earlier on, in discussing how the process of SWMS was expected to work, PAR023 suggested that the document itself was used to check off against familiar and unfamiliar hazards. In the case of engaging with a new subcontractor, the informant also talked about challenging the process and the thinking that has gone on at each stage:

'We do an all up challenge, a core challenge to the process is that, have we managed that to a level that is largely going to be practical so we actually challenge that at each stage. Then we get that peer reviewed internally and then that gives us something to lever off and take off from there'. PAR023

The aim is to have a document that is expected to be practically useful for the trades. In this organisation, 'peer review is used to start this process'. The informant goes on to reflect on the essence of peer review:

'Initially there will be, as a development, there will be one of their staff people. Normally one of their managers and myself and we will try and develop something, a basis, a foundation document if you like, but "let's put some meat around this and then let's go and test it. Let's go and test the document. Let's go and check to make sure that it works. Let's see if any of the other staff have some input that they would like changed and added or so because the people that use the document has to have that input so they own it". If you don't get that engagement at the coalface there is a disconnect, so the challenge we have is how do we connect the SWMS or the process around the SWMS, the intent of what we want to achieve. The outcomes, how can we connect that to the people that need to own it or use it and that's why that peer review is so important'. PAR023

According to the above, peer review is used to test the efficacy of the document itself, provide opportunity for staff input and make a connection between the workers and the work being undertaken. In doing so, there is a realisation that the SWMS that is developed by experts who sit outside the work may be disconnected with those doing the actual work, and it is necessary to engage with them. The peer review used in this stage of the process serves to act as an avenue for reflecting-on-process for the prescription of the SWMS document (Nathanael & Marmaras, 2008b). The main outcome of this process is a document that the trades are able to make a connection with, based on an understanding that because the trades have not been involved in the development they may not be able to relate to them.

6.2.1.6 Summary

The above section discussed the findings of Organisation B managers, which are summarised in Figure 19.

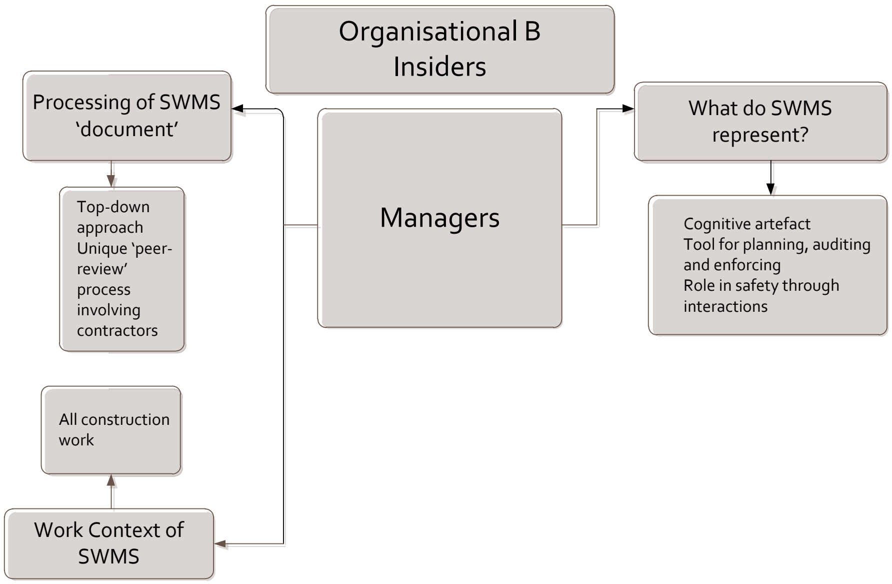

Figure 19: Summary of Organisation B Managers' Views

6.2.1.7 Comparisons between Sites

Some of the views expressed here were similar to managers of Organisation A, in particular SWMS having a role in safety. However, there were also subtle differences in how these were expected to occur. For example, in Organisation A, SWMS brought about safety as a set of rules, while in Organisation B it came about through interactions on site. Similarly, the process of SWMS in Organisation A is about efficiency, while in Organisation B it is more geared towards planning for safety. Managers here, however, do not subscribe to the view that SWMS provide legal protection.

6.2.1.8 Comparisons with Organisational Outsiders

The view of managers in this organisation that SWMS represented a form of cognitive artefact is similar to the government/regulator. The main difference between the two is the contexts of work for which SWMS are expected to be useful for. Here managers believe they are important for all construction work, which in some ways appears to be the view of the association, as opposed to the government/regulator, which views it as being necessary for a set of (designated) high risk work. The view that SWMS act as a form of control held by the association is something that appears not be shared by the managers here. In this case, the managers clearly see the interactions that bring about safety, not the completion of the document alone. Again, this appears to be similar to the government's/regulator's thinking.

The last section discussed the views of managers in Organisation B, and compared and contrasted the findings with organisational outsiders and managers of Organisation A. The next section looks at the findings from the supervisors.

6.2.2 SUPERVISORS' VIEWS

The perspectives of Organisation B supervisors are based on an analysis of data collected from 11 key informants (see Table 23). Five were construction supervisors employed by the organisation, five were roof tiling supervisors who had been subcontracted, and one was a carpenter and foreman who had also been subcontracted. Most of these supervisors had worked in the construction industry for between four to 26 years, and between four months to 15 years with the current organisation.

The interviews were triangulated with a series of documents, including the organisation's site OHS and environment audits (see Table 24).

The key themes that emerged here were that SWMS: (i) provided legal protection and (ii) had a role to play in safety. The supervisors had mixed views about jobs that required SWMS; they also made revisions to SWMS by working from generic ones.

Table 23

Profile of Organisation B Supervisors

Participant	Position	Education / Training	Exp. in Cons	Length in Company
PAR001	Construction Supervisor	XXX	11 yrs.	3 yrs.
PAR002	Construction Supervisor	XXX	6 yrs.	2 yrs.
PAR004	Construction Supervisor	XXX	25 yrs.	5 yrs.
PAR005	Construction Supervisor	XXX	26 months	4 months
PAR006	Construction Supervisor	XXX	14 months	8 months
PAR007	Roof Tiling Supervisor	XXX	5 yrs.	5 yrs.
PAR009	Roof Tiling Supervisor	XXX	15 months	1½ yrs.
PAR010	Roof Tiling Supervisor	XXX	9 yrs.	1½ yrs.
PAR011	Roof Tiling Supervisor	Year 10 / TAFE	9 yrs.	7 yrs.
PAR014	Roof Tiling Supervisor	TAFE	15 yrs.	15 yrs.
PAR022	Carpenter / Foreman	Year 12	4 and ½ yrs.	2 yrs.

The monitoring of SWMS was mostly aimed at checking off on the paperwork, and there was a tendency among some supervisors to make decisions in favour of production against safety.

Table 24

Documentary Sources—Organisational B Supervisors

Documents	Version
Site Occupational health and safety & environment audit sheet	
Completed Site occupational health and safety & environment audit sheet – single story	4.9.11
Completed Site occupational health and safety & environment audit sheet – single story – fitting out stage	Job No. 6712
Completed Site occupational health and safety & environment audit sheet – Brick Stage	13.11.11

6.2.2.1 SWMS Provide Legal Protection

A common view among Organisation B supervisors is that SWMS provide legal protection:

'Basically it's [Organisation B] looking after themselves'. PAR002

This informant goes on to add:

'Yes. That's from, basically, [the regulator]. That's what the law is, the regulations, OHS'. PAR002

Thus, this informant suggests SWMS are legal because they are laid down under the Building Code through the OHS regulations, and it for this reason these supervisors treat it as being important. The importance of SWMS being a legal requirement is also pushed to the subcontractors, as the following excerpt suggests:

'What you try and stress is that it's not about us. Like, it doesn't matter to us, but if [the regulator] come over; it's you that will be in trouble to our subcontractors. Because really, they're on site and they haven't got it, sure, we can get in trouble, but it's mainly to cover them as well. So we try and stress the point that it's for them more than anything else. They have to cover themselves'. PAR002

This view of SWMS providing legal protection is also shared by some of the trade supervisors themselves:

'So it covers, all it does is cover people's backsides. If, I don't know, if you fill out a SWMS and then something happens, you've got the paperwork there to say, "Well it was safe to do it". If you know …'. PAR007

For him, if he has filled in the paperwork and something happens (such as an accident), then he would be able to show that the possession of the SWMS paperwork suggested it was safe to do the job. Another informant provides a working example:

'Like, you've seen the handrail. We'd have to take it apart to put the elevator, as soon as the elevator's[33] down the handrail gets put straight back up for the next person to use. For instance, if we're working over the bricklayers or something we get them to sign the JSA as well, so they're aware, so it's just printed down that we warn them that they are working underneath the 0:10:25:7 if anything was to happen, it's on their shoulders for taking the risk, not us'. PAR010

What the above informant is alluding to is typical of what happens on site; he is a roof tiler, he will be moving roof tiles that could fall off onto and strike any bricklayers who may be working below. By getting the bricklayers to sign onto his SWMS, he moves the responsibility for managing an aspect of the risk away from himself to the bricklayer. Other informants made similar comments:

'Because, we don't like working without them there, and if something happens we're covered. We've let them know what the risks are'. PAR009

'In case something happens it's not our fault'. PAR010

The excerpt above is suggestive of a culture of risk transfer, something that was evident from subcontractors in the New South Wales construction industry (Loosemore & Andonakis, 2007; Wadick, 2005a). The supervisors believe that having a documented SWMS that has been signed on by other trades effectively removes them from any liability should things go wrong.

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33 The elevator he is referring to involve a roof tiling machine (RTM) which is used to transport stacks of roof tiles from the ground. To set up the RTM, a section of the top and mid-rails around the perimeter protection have to be removed, creating a risk of materials falling off from that section of the unprotected edge and striking anyone working below.

6.2.2.2 SWMS Have a Role in Safety

There is a view among some of the supervisors that SWMS did have a role in safety.

'Obviously safety. Safety's the number one thing. That's why'. PAR001

'To try and keep a safe workplace, I suppose. To inform the subcontractors or contractors on site of the issues of safety and what's required by law'. PAR001

'First of all, it's obviously safety. Safety's the number one priority. And then just for a cleaner and, you know, safer worksite for everyone'. PAR001

According to this informant, SWMS created safety by: (i) establishing what was required by law, (ii) informing the contractors and subcontractors about the requirements, and by (iii) creating a cleaner worksite. Another explained the links in this way:

'I think probably the main thing is risk assessment. Getting the people that are working on a particular site to really see if there is any risks or any potential risks in their normal line of work and to identify it and then to do something about it'. PAR004

He goes to provide an example:

'See, with the particular SWMS that we've got, it's basic, and it gets you to think about it, but if there's lack of egress or something like that, identifying it and then finding a solution and I think that's the main thing. As long as people have thought about it and how to find a solution safely. It may be changing the scaffold or moving some materials or whatever'. PAR004

In effect, SWMS is expected to assist in thinking about safety aspects of the work at hand. Flagging a safety issue also means the trades are able to think about ways of dealing with the safety issue. Another explained it this way:

'The SWMS is a guide to help a subcontractor to conform to work safe on a job site'. PAR006

For him, SWMS act as a guide to doing the job safely by conforming to rules and or/procedures that are laid down, a view that seems to be supported by the following:

'I think everyone understands that they've got to follow procedures and all that. They understand if they're not doing the right thing, well'. PAR006

Others talked about SWMS and safety in the following way:

'Yeah, just making them aware of the risks. Making them have to think about it'. PAR005

'Make you think about the job before you start it'. PAR014

'Just aware of the job surroundings, what's there, yeah? Your potential hazards and whatever else, so you can say, "Get the job done". And that's that'. PAR014

These informants suggest SWMS made them aware of hazards and surroundings by encouraging them to stop and think about the work. In this case, it appears to be used as a tool as well.

6.2.2.3 Work Contexts for SWMS

A common theme that appeared to emerge from the interviews in this organisation is that SWMS are required for some jobs, not others. This was evident from some of the supervisors:

'They've just come in for tiling in the last two years I reckon'. PAR009

He goes on to explain:

'And before that bricklayers don't have to fill them out. Plumbers they don't have to fill them out. It's just roof tilers at the minute, so I don't know what's going on'. PAR009

According to this informant, the requirement for roof tilers has just been introduced in the last two years, and he believed that plumbers did not have to fill one out. Another could only talk about his experience:

'Two metres fall height. That's the one I'm dealing with at the moment'. PAR014

Others, however, suggest they were required for all trades:

'That's all part of the requirements of [Organisation B], is that each subcontractor fill out a SWMS per job'. PAR004

He provides an example of recent SWMS he had worked with:

'So, it was our carpenter. It was working on a scaffold'. PAR004

I then sought to clarify whether the SWMS was required because of the carpentry work or because this involved working on scaffolds. His reply was:

'Both. There are a couple, for carpentry and working off scaffold'. PAR004

According to him, a SWMS was required because he was doing carpentry work, and also because there was a scaffold involved. This seeks to reinforce that SWMS were required for all works.

6.2.2.4 Revisions and Changes

In terms of supervisors' involvement in reviewing and changing SWMS, a number of different explanations were provided:

'Basically, what happens is we have a file full of SWMS that is provided from us, they're updated, obviously, when [OHS personnel] updates and he gives us the new ones, but as far as updating its back onto the contractor, and revising that sort of thing'. PAR005

Two things are being suggested here. One is that the company makes available stacks of generic SWMS that have been updated by the OHS department. The second is that any revisions that need to be made is the subcontractor's responsibility; he is not involved directly in any of the revisions directly. However, another supervisor suggests he is involved in the changes in the following manner:

'It's only like an example now, what I'm doing this, where it's the update for the two metre fall height, so I'll just come out and say, "That's where it's been updated. There's a new JSA". That changes under SWMS so I'll highlight the point where it changes on there'. PAR014

In the above example, the supervisor refers to a recent change where SWMS were now required for all work being done in excess of 2 metres, and he would discuss with his trades where this change had been captured in the JSA and SWMS. At another point, he goes on to suggest the following:

'Every site that we go to is different. So your SWMS is basically generic, how we put a roof on. But every job site is different. So your JSA will reflect that. Most of the jobs, like I said, we try to pick out all the problems beforehand, so we keep the JSAs pretty basic, or try to keep it basic for the boys, but as I said, it's more relevant to working with the SWMS if they're not sure'. PAR014

I then sought to clarify if 'distinctions in practice' may actually occur on this site by asking the supervisors to discuss the case where the written SWMS may not actually work. The following excerpts illustrate what happens:

'We've had a couple, I think one in—we've had a couple of sites where I suppose we had some concerns, as in access. We have a school very close by, and also the council office was right across the road, and I think [manager] spoke to [OHS officer] and they had a discussion on what they wanted to, and how to manage that, and which was related back to myself. But we thought, we spoke about this before we started, so the observation was there'. PAR006

The above excerpt suggests that work cannot be done in accordance with the normal ways of working, there would be involvement of higher-level management, who would then interact with the external factors involved, and he would then act on what was communicated to him. The following relates to a specific example:

'Working at heights'. PAR005

'Working at heights. And there was a bit of a problem with the carpenter putting up the roof truss, because it was on the second floor, and that was brought to OHS attention, and we sat down, and I think it was a meeting for everyone, all the construction managers, and site managers, and we spoke for about an hour on the importance of working safe, and there were general flyers put out, which had the safety alerts, and suggestions on how to get around that, and that one again I think was a pretty tight site, double-storey. So that's how it's communicated back to us, in meetings, and the safety alerts, and they're popped in our tray as well, every week, and we also get emails on them as well'. PAR006

According to the above, things that are observed not to work are discussed at group level that involves construction managers and the OHS function. This typically occurs at one of the weekly meetings that the managers and supervisors are expected to attend, and is held at the head office. Acceptable work practices are then agreed upon and communicated through flyers. Discussing and resolving a concern outside of where it is actually occurring appears to be a form of ROA, and the formalisation of accepted ways of doing such work in future are elements of the 'descriptions' loop suggested by Nathanael and Marmaras (2008a, 2008b). This could suggest that the 'distinctions' loop proposed in the PRDD model may not occur, or may not be as evident.

I then sought to understand the extent to which subcontracted trades were involved in making changes or revisions to SWMS. One informant explained how he would do this:

'We've got a generic one, so the only thing that changes are the conditions from the site to site, so you fill it out being site-specific'. PAR007

He goes on to explain what would happen if he went onto the next job:

'It's exactly the same, and then you fill it out being site-specific. So for example here there's timber on the ground, there's brickwork'. PAR007

When asked to reflect on at what point in the work cycle this normally occurred, the following was provided:

'Before we get our boys to come and work we've got to fill it out, and whether the site's safe, and ready to go, before they even get there'. PAR007

So his experience is that generic SWMS developed by his company are brought onto the job site, reviewed and updated to include site safety issues before work is commenced.

6.2.2.5 Monitoring of SWMS

According to the managers here, supervisors were expected to monitor the use of SWMS. At a minimum, this involved asking the trades for a written document, and giving a template from Organisation B as a 'framework' for the trades to get started with. In addition, they were expected to monitor the availability and use of SWMS. One informant explained what he did in the following way:

'Basically, what we do is we have a safety audit, which we do once a week on a particular supplier, or a subcontractor. That audit runs, I think it's about 40 questions. It's tick box. One of the questions is: has the subcontractor or supplier filled his SWMS? And they're actually provided in a folder for each trade from [Organisation B]'. PAR005

This informant suggests they undertake an audit of the presence of paperwork. This may also involve whether it has been filled in properly:

'Check that SWMS against our audit, and make sure that they've filled it in correctly'. PAR005

What is deemed 'correct' is not clear; the audit sheet that is used by supervisors comprised two questions: (i) whether a SWMS has been completed and (ii) whether a SWMS was available on site. What is apparent is that actions are taken if the SWMS fails to meet the test of 'correctness':

'As I said before, we either help them on site, fill it in, if that's possible, or we issue them with an instruction notice, and a time frame to fix their problem, which is probably more like they've just forgotten their paperwork sometimes'. PAR005

One form of this action involves helping the trades fill in the paperwork, while the other involves formal 'sanctioning' through an instruction notice, supported with a time frame to get the written aspect complete. This latter approach is also used by health and safety inspectors to enforce legislation (Bluff & Gunningham, 2004; Bluff, Gunningham & Johnstone, 2004; Creighton & Rozen, 2007; Stewart-Crompton, Mayman & Sheriff, 2009). The stance taken above suggests the emphasis is on getting the paperwork aspect correct.

I sought to understand whether the monitoring by supervisors also extended to whether work was done in accordance with the SWMS. However, this does not appear to happen:

'Whether practically you can do that is another question. So that's where it breaks down'. PAR002

When asked whether this was because the document itself was not suitable or if it could not be used, he provided the following:

'More than anything, it's just not practicable to do it for every trade, for every day, for every job, for every site. It's not practicable. And the building regulation states you have to do things. Like, for a builder, in a practicable way, as much as practicable and it's just not'. PAR002

The above excerpt suggests that what is actually required in the SWMS may not be possible to do; the use of 'practicable' suggests there is a choice available to the trades to do what they can do. Hence, there is an option for trades to do what is suggested on the SWMS, or something different. Another informant suggested the following:

'It's a compliant regulation. You don't have enough time in the day to make sure that everyone—I mean, you get around and make sure that they've got—you try to get to everyone and make sure that everyone …'. PAR001

The second point being made is that the regulations for SWMS are a form of 'self-regulation' (Hart, 2009; Johnstone, 2004; Levinson, 1987; National Research Centre for OHS Regulation), so it was up to the subcontractors to comply with the SWMS. The arguments that workload issues prevented them from going around may serve to support this point. This is also evident from the following discussion that occurs between the two informants:

'The way that they want it is, every job, where you usually have 15 jobs for every trade, for every day, for every job'. PAR002

'You'd be there all day at one job to make sure that everyone complies, you know'. PAR001

According to the above, the practical problem appears to be compounded because they will be working with 15 different trades, each of whom will have a different SWMS. Moreover, others such as those delivering materials on job sites are also expected to have SWMS, so these can become problems

'To enforce it and to make sure that everyone …'. PAR001

'There are a lot of things that work in your brain. There's a lot of things that work where you talk about things, but actually putting that into the process, it doesn't work'. PAR002

What he is alluding to is that a lot of cognitive work goes into making sense of what is expected to happen on the site (McGinnis, 2007a; Weick et al., 2005). Many things could be discussed; however, they are not necessarily written down. He goes on to provide an example:

'Say at the site the brickie's there and then it rains, the next day they're meant to adjust their SWMS because there's obviously different risks on that site because it's obviously wet, slippery'. PAR002

His colleague adds the following:

'Now, they're required to change that every day and the way it is that we've seen to be that we need to be around there to sort of see that they've changed it every day to comply, but it's impossible to get around to every job. You try. I mean, you enforce as much as you can though'. PAR001

For example, if bricklayers are working under an existing SWMS, and it rains on the day, they are expected to revisit the SWMS because the risks will have changed. What he points out is that, as much as they would like to try, it is impossible to monitor if the subcontractors have made the necessary changes. This does not necessarily mean that SWMS documents are not subjected to a review process by the supervisors. This is evident from the following:

'We do review it. No, we do. That comes to us a lot of times when it's signed extras … they have to send that form in with us and we actually go through it and make sure that it's okay and all that'. PAR001

It is not clear what this 'going through' involves, and what the criteria for 'okay' is. There is some suggestion that this monitoring did involve some level of observing the conduct of work, and taking action to correct them:

'Now, sometimes you see them on site doing stuff they shouldn't be doing and you let them know straight away that's not correct'. PAR001

When asked to explain the type of actions they would normally take:

'If they don't want to fix what we've told them to do, get off-site. Get down'. PAR001

The above excerpt suggests one way to get the process started is by getting the trades to get down or off the work site; in this instance the approach used is the giving of oral directions (Creighton & Rozen, 2007; Stewart-Crompton et al., 2009). Such approaches are also used by health and safety regulators, but under circumstances where there is likely to be 'immediate risks to health and safety' in Victoria (Creighton & Rozen, 2007) or 'imminent risks to health and safety' under the harmonised arrangements (Stewart-Crompton et al., 2009). The primary use of this approach is to 'eliminate risks to health and safety', not necessarily fix up paperwork. Another supervisor provides an example of how he normally addresses the issue:

'You might have someone on a ladder which is unstable, you say, "Look get off the ladder, chock it up properly"'. PAR006

According to him, he would take proactive action, including asking the trades to get down (if it involves working at heights), getting off-site or making the ladder more stable by chocking it up better.

What is being suggested above is that there is some 'collaborative cross-checking' involved (Patterson, Woods, Cook & Render, 2007). This, according to the authors, was 'a critical component of resilience because erroneous assessments or actions can be detected quickly enough to mitigate or eliminate negative consequences' (Patterson et al., 2007, p. 156). In the above instance, the supervisor is collaborating with the trades to get off (thereby eliminating the negative event of falling off from an unstable ladder), and directing him to chock up the ladder in a more proper manner; both are expected to mitigate the risk of an adverse event, such as falling off the ladder. What is also clear is that achieving safety, as far as these supervisors are concerned, involves a direct interaction between the supervisors and the trades, hence is a form of social construction (Gherardi & Nicolini, 2002a, 2002b; Turner & Gray, 2009).

6.2.2.6 Sacrificial Decision-making

There are suggestions that supervisors do make sacrificial decisions that seem to support production. The following discussion serves to illustrate this point:

'I had a bricklayer, just with, I know it's hard but tight access, there's so much stuff crammed on blocks these days it's hard to get access around sites and as a company, they sort of drive you to succeed and finish jobs at a certain rate, but on the other hand, too, they want you to make sure you do it safe. Sometimes you've got sand there, you've got bricks there, you've got everything there, and it's sometimes not safe for the contractor. But there's nothing you can do'. PAR001

Another supported this view:

'If you've got a tight site, SWMS are not going to help you. You have to work around what you've been given'. PAR002

The reference to 'working around' is suggestive that decisions may be made to sacrifice some of the specific requirements pointed out, that what is suggested in the SWMS may not be followed. This point was reinforced in the following way:

'You just have to work around it'. PAR002

'You sort of have to work around it'. PAR001

Working around is also suggestive the supervisors will need to make some adjustments and/or compromises along the way. I sought to understand whether this meant some safety precautions would be bypassed. One informant did open up by suggesting that:

'What you've got to understand I suppose in a way is if you've got your boss or someone telling you we need to have the job done, you do it'. PAR007

He suggests where managers directed that the work be continued, even if it meant bypassing safety requirements; this is more likely to be done. In some ways this is illustrative of a lack of 'resilience safety culture' (Akselsson, 2009) or lack of commitment towards safety (Flin, 2006; Weeks & Benade, 2009; Wreathall, 2006), something that was likely to encourage workers towards risk-taking behaviour. However, some supervisors suggested this was not the case:

'It's always a first priority to make sure that everyone is safe on site. Working safe; put it that way'. PAR006

'But one thing I'll point out is that nowadays SWMS, or any of that stuff, is a lot different, and we've got a policy pretty much along the lines of, if our boys don't feel comfortable doing something, they call us straight away. They don't have to do it. If you don't feel comfortable, you don't do it. It's pretty simple'. PAR007

According to the latter, his organisation's policy was that the trades were not compelled to do anything they felt uncomfortable with, and were free to call the supervisors. He goes on to explain:

'It's an individual thing. If you don't, if [PAR008] doesn't want to do something, [PAR008] doesn't have to do it'. PAR007

The above excerpt serves to suggest that continuing to work amid safety concerns was a 'choice' for the workers themselves.

6.2.2.7 Document Analysis

I reviewed the site OHS environment audit to see what types of things are 'monitored' in as far as SWMS are concerned. The audit includes a 12-point checklist that covers, (1) site information and procedures, (2) site conditions/housekeeping, (3) hanging bracket scaffold seven working at heights, (4) items of plant and trenches, (5) electrical tools and equipment, (6) trades, (7) general comments, (8) safety chat/points raised, (9) persons present during discussion, (10) table for documenting action, person responsible and sign-offs for completion and (12) a section that requires a sign off against the statement: 'Have you eliminated all potential risks from any other hazards identified on site that may affect work tasks?'

The checks for SWMS are covered in the following sections:

1. Site information and procedures

    a. Do trades/suppliers on site have a SWMS and is the trade operating in accordance with their SWMS?

    b. Are site fall hazards (e.g., retaining walls) identified on site sign on or SWMS?

4. Items of plant and trenches (high risk works)

a. Is there a pre-start checklist and SWMS completed for the item of mobile plant?

The checklist also lists a number of items as being 'high risk works', including: (i) void protection, (ii) roof guard rail and condition and access, (iii) ladders and (iv) items of plant and trenches.

A review of the document suggests that four specific set of works are classed as high risk, and that both the presence of SWMS and a check of whether trades are performing their work in accordance with the SWMS are required to be monitored.

6.2.2.8 Summary

In this section I have discussed the views of SWMS according to supervisors in Organisation B, these are summarised in Figure 20.

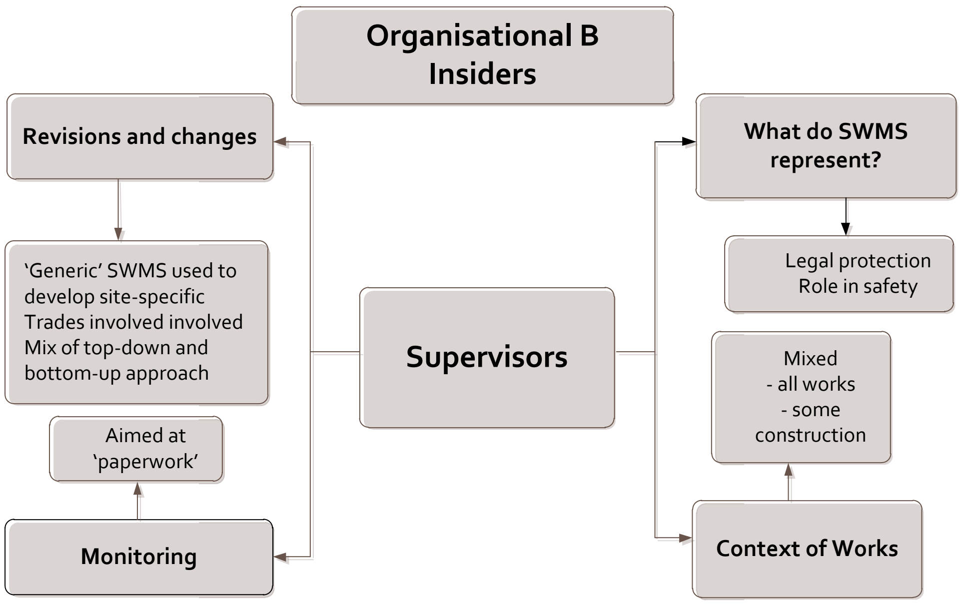

Figure 20: Summary of Organisation B Supervisors' Views

6.2.2.9 Comparisons within Site

The two common views that SWMS are a process and a tool held by managers in this organisation is not necessarily shared by the supervisors, although some supervisors did talk about the process they would follow for changing SWMS. Similarly, the view that SWMS provided legal protection held by supervisors is not something that is common to the managers here. However, the view that SWMS are required for all construction work resonates with some of the supervisors.

In a similar manner, the view that SWMS is associated with safety held by managers is also similar to the supervisors. However, the way this is expected to come about is different between the two groups. Managers believe safety arises out of the interactions that occur on site between the supervisors and the trades, not the completion of the paperwork itself. This is suggestive of safety being socially constructed (Gherardi & Nicolini, 2002a, 2002b; Turner & Gray, 2009). While some supervisors do hold a similar view, others believe safety comes about from flagging issues of safety, thinking about the work and risks associated with it and generally creating awareness. The common thread between these is that SWMS somehow play a mediating role in terms of safety.

6.2.2.10 Comparisons between Sites

The view of SWMS providing legal protection held by supervisors of Organisation A is also common to the supervisors here. In the former, this is expected to come about through SWMS being used to meet duty of care obligations as a principal contractor, while in Organisation B this comes about as a result of transferring its legal obligations to the subcontractors. Supervisors in organisations A and B both believe SWMS have a role in safety (and through very similar mechanisms); they also have a mixed understanding of types of construction works for which SWMS are relevant or required. Supervisors of both organisations are involved in revising SWMS; however, in Organisation A these changes may not necessarily result in changes to the way work is done. What is clear is that supervisors believe that while they may have some form of control over the paperwork, monitoring whether work is being done in accordance with the SWMS is problematic because of the large number of sites they are managing.

What also appears to be common to the supervisors of both these two organisations is that the monitoring of SWMS appears to be more directed at ensuring the documentary aspects. This is suggestive that achieving legal protection from SWMS is a higher-order goal, not necessarily safety (Cook & Nemeth, 2006; Nemeth & Cook, 2007; Nemeth et al., 2007).

6.2.2.11 Comparisons with Organisational Outsiders

The only view of SWMS supervisors of this organisation have in common with the government and regulator relate to safety. There are, however, differences in the way this is expected to come about. For the latter, it is through identification of hazards, risks and control measures, while for supervisors this is through things such as informing, bringing to the forefront issues of safety and potential solutions for dealing with them, and through the following of rules.

The view of SWMS as a live, risk control strategy espoused by the government and regulator by ensuring SWMS are revised also appears to resonate with some of the supervisors, who suggested all jobs were different, so the SWMS they worked on were required to be reviewed and updated from site to site. However, the view that SWMS is a tool for planning and interacting held by the government and regulator is not something that is shared by the supervisors here.

In a similar manner, the views of the association that SWMS are a form of control are not shared by the supervisors of this organisation. However, the view that SWMS are required for all construction works held by the association is also similar to some supervisors here.

6.2.3 WORKERS' VIEWS

The perspectives of Organisation B's workers are based on an analysis of interviews held with 12 key informants and samples of documents (see Table 25). Most of the informants had completed schooling ranging from years 10 and 12, while a few had also completed TAFE training. Seven were completing their apprentices, two had completed their training, and the other three were experienced tradesman without any TAFE qualifications.

Table 25

Data Source for Organisation B Workers

Informant	Position	Education / Training	Length in Construction	Length in Company
PAR008	Roof Plumber	XXX	2 ½ yrs.	2 ½ yrs.
PAR012	Apprentice	Year 12	1 yrs.	1 yrs.
PAR013	Apprentice	Year 12	2 yrs.	2 yrs.
PAR015	Plumber	TAFE	7 yrs.	1 month
PAR016	Apprentice Carpenter	Year 12	3 yrs.	3 yrs.
PAR017	Carpenter	Year 12	3 yrs.	4 yrs.
PAR018	Apprentice Carpenter	Year 10	4 yrs.	1 ½ yrs.
PAR019	Apprentice Carpenter	Year 12	4 yrs.	1 ½ yrs.
PAR020	Apprentice Carpenter	Year 10	3 yrs.	2 ½ yrs.
PAR021	Apprentice Carpenter	Year 12	2 ½ yrs.	2 ½ yrs.
PAR022	Roof Tiler	Year 12	4 ½ yrs.	2 yrs.
PAR024	Bricklayer	Year 12/TAFE	14 yrs.	8 yrs.
Documents				Version / date
Company SWMS - Bricklaying				SWMS -01A
Company SWMS – Carpenter Framing				SWMS-04A
Company SWMS – Concrete Slab				SWMS-09A

Eight workers were employed as carpenters, two as roof plumbers and/or tilers, one as a plumber and another as a bricklayer. The informants had worked for one to 14 years in construction and had been with the current organisation from one month to eight years. The two common themes that emerged here were that SWMS: (i) had a role in safety and (ii) was a tool. In addition, interactions were also deemed important for safety.

6.2.3.1 SWMS Have a Role in Safety

According to some workers, SWMS had a role in safety. An example of this view is evident in the following excerpt:

'Point out safety, pretty much'. PAR008

When asked to explain what this meant, the informant provided the following:

'By actually doing what it says'. PAR008

For the above informant, SWMS was about following procedures and this could bring about safety. Others talked about safety and SWMS in the following way:

'Probably safety at work to minimise injuries and all that sort of stuff at work'. PAR012

'To stop you getting hurt'. PAR013

'Just to make sure that everyone understands how to work safely on a job'. PAR015

When asked how SWMS did these, the following were the responses:

'Have something to work with'. PAR015

'It tells you the correct way of doing the work safely'. PAR015

Others made similar comments like:

'How dangerous the job site is. What's safety? What safety equipment you use when you're using tools'. PAR018

'They say just safe, safety, precautions on the job, and how to work safe'. PAR019

'It's designed to help everyone understand what they're doing and to keep everyone safe'. PAR022

What the above excerpts appear to allude to is that having a SWMS assists them in thinking about safety aspects of the work better, including reminding them about some of the basic safety precautions that need to be taken on site.

6.2.3.2 SWMS are a Tool

Another common theme that emerged from the interviews with the workers is that SWMS acts as a useful tool for doing a number of different things. One is for identifying hazards and threats of the job about to be undertaken.

'Only on site when we are going through it; sort of write down extra hazards that may not be on their … [They] may not have been already pointed out and rectified before we get to the job'. PAR008

'By identifying the problems on the job site'. PAR012

'It asks you a series of questions about whether you are happy with … the way the site is, and we fill it out and … tick the boxes that need to be ticked … and we make sure we do the things that we should be doing'. PAR024

Another is as a guide to doing a job:

'Just tells you the safest way to do the work, shows you step by step how to go about the job safely'. PAR015

*'I just use them as a guide … It's a reference guide to a job you're about to do and just the safety *0:05:12.5 course you've got to look out for, and what tools you'll be using there'.* PAR017

'Steps and cautions on how to execute the job the way you're supposed to'. PAR020

As a guide, SWMS acts as a reference document, shows steps for doing a job and draws attention to how things are expected to work.

A third use of SWMS as a tool is for decision-making. This appears to be in some instances where threats have been identified and a decision has to be made about what is expected to happen next. According to one informant:

'Then you'd go back to your supervisor, and explain to them what's wrong with it to rectify the problem in the first place, like to get them to rectify the problem so the work can proceed'. PAR008

Others explained the use of SWMS for initiating action in the following way:

'Probably call the builder to fix it, or if it's not in your area, don't touch it. Like if you're not a sparky, don't touch electrical stuff'. PAR012

According to the above, the decision-making extends to initiating interactions with supervisors, so it could be suggested that it is a tool for initiating interactions about the work and about the safety of the work. I sought to understand some of the interactions that occurred in the doing of work by the workers. Again, this generated a range of responses:

'Just by coming to get us as a group and discussing like the situations that are on the job site, and you know how we can do it safely'. PAR017

'Toolboxes'. PAR018

Another provided a very refined view of the importance of interaction on site, by distinguishing between the paperwork and the process:

'It's not the paperwork more to say, it's more discussing it before the end of the day—sorry—before the start of the day'. PAR022

For him, it was the discussions that went at the start of the day that were more useful for the trades. He goes on to suggest what is included in his discussions:

'We'll discuss what is going on and what's happening and what precautions we have to take with the SWMS'. PAR022

For the workers, the interactions were around the work at hand, issues of safety and what precautions to take. Again, at this level, this suggests that safety is very much a social construction (Gherardi & Nicolini, 2002a, 2002b; Turner & Gray, 2009), with SWMS providing a useful way of initiating or mediating the interactions.

6.2.3.3 Anecdotes from the Field

While in the field, I observed a number of activities over a course of six visits. These included roof plumbing and roof tiling and excavations and foundation works at three medium-density (double-storey) construction sites. The main trades involved in these works included roof tilers, roof plumbers, excavator operators, concreters and labourers. A series of snapshots depicting the excavation and foundations for the medium-density construction work are illustrated in Figure 21.

Figure 21: Excavation and foundation works on a medium-density construction site

This work was initially done by a team of about nine workers comprising carpenters, labourers, concreters and excavator operators. What I observed challenged me. For example, in digging up the slab foundation, I observed the carpenter and labourer continued to stay and work close to the buckets of a two-tonne excavator less than half a metre away, very similar to the trenching works for the drains I had observed in Organisation A. Doing such work generally requires a clearance zone of at least two metres in and around the excavator (Safe Work Australia, 2011a; 2011b); however, this was being bypassed almost all of the time.

What was fascinating to watch here were a combination of hand gestures and eye contact between the excavator operator and crew that was maintained throughout the excavations and trenching works. I later found out the signals were pre-arranged the first time the team worked together on the site. The person who appeared to have control over the activities was the excavator operator. He decided when it was okay to dig, when to let the bucket rest and when to continue. Perhaps I would describe the experience as 'working close to the edge' of being struck to death by an excavator. What became clear here also was a deep sense of trust that had developed between the excavator operator and the workers. The workers trusted that the excavator operator would not strike them down, who in turn, trusted that the workers would continue to be in his view at all times, and use the hand signals appropriately.

The second work I observed included roof tiling and plumbing works on a medium-density construction, illustrated in Figure 22.

Figure 22: Roof tiling on a medium-density construction project

The main trades involved here were roof plumbers and roof tilers, together with apprentices and labourers. During the course of my observations, different degrees of changes in wind and rain were experienced over the two days this work was done. On the first day, there were slight drizzles and light breezes, with increasing speeds over the course of the day. Similar to the roof plumbers I had observed in Organisation A, the roof tilers did no more than give a cursory look at these, and continued to work across the day. When the wind picked up speed, I observed the team break up early for 'smoko', which also meant they left the site at around 2 p.m. (as opposed to 3 p.m., which was the norm).

However, on the second day it was windier, also a lot more wet because of the rain that appeared to have fallen the previous night. As I joined the team at around 7 a.m., I observed this team were still on the ground. From the discussions I held, they had another two days of work on that particular building, and were waiting for the weather to become better. I viewed the JSAs used for this job, and noted that 'wet weather, slippery top' and 'falling from height' had been added in black ink. The two partners indicated they would not normally add this on the JSA but had been advised to do so by the contract supervisor the previous evening, because of the 'OHS stuff that is going on'. I took this to mean either my doing research or the recent safety alert that had been issued to trades regarding how SWMS were to be treated on site. The supervisors also stated that they would generally monitor the change in conditions and decide on the day if it was safe to work; moreover, instead of relying on the JSA/SWMS they would use their previous experience to decide if it was safe to work.

Again, the response repertoire on this work also represented to me a form of episodic adaptation (Grøtan, 2011; Grøtan et al., 2008) in 'a small packet of order' (Grøtan, 2011, p. 102). This adaptation can also be analysed through the REL model (Grøtan, 2011). By subtly paying attention to the changing weather conditions (*entry point*), the roof tiling team developed an anticipation of the risks; this targeted *risk understanding*. The four-member team responded in an organised sequence: first, by continuing to work on the first day, then stopping altogether to think of a new strategy when the weather worsened on the next day. This acted as the *release chain*. By stopping work altogether, the workers responded to the threats they faced, in this case, the two supervisors deciding to stop work altogether and continue monitoring. For me, this was another example of an episodic adaptation demonstrating a form of resilience with production being sacrificed in favour of safety.

6.2.3.4 Summary

The views of workers in this organisation suggest that SWMS bring about safety through acting as a source of action in terms of the right way of doing things, making them aware of what personal protective equipment (PPE) to use, and what precautions to take. Workers also believed they were useful as a tool for identifying hazards and threats, as a source of reference and for assistance in making decisions on the job.

6.2.3.5 Comparison within Site

The two views that appear to be common between the managers and workers here is SWMS having a role in safety and acting as a tool. The managers' view of SWMS as a cognitive artefact, and relevant for all construction work, do not appear to be shared by the workers here. The one view of SWMS that appears to be common between the supervisors and workers is the role it plays in safety, with a similar understanding of how it is expected to occur. However, the understanding that SWMS provide legal protection, or the mixed understanding about types of construction work that are relevant to SWMS espoused by the supervisors are not necessarily shared by the workers here. This is despite the fact that both the supervisors and workers appear to have had similar years of experience in Organisation B.

The common view that SWMS play a role is safety is something that appears to flow from managers to supervisors and workers. The way this is expected to come about is largely through the interactions that go on at site level.

6.2.3.6 Comparison between Sites

The views that SWMS have a role in safety are shared by workers of both organisations A and B. However, the view that SWMS are a tool held by workers here is not shared by workers in organisation A. Similarly, the mixed views about the types of construction works to which SWMS were relevant to held by organisation A workers is not shared by workers in this organisation.

6.2.3.7 Comparison with Organisational Outsiders

The two common views of SWMS, that it has a role in safety and is a tool, are also common between the workers and the government and regulator. However, the view that SWMS is a live strategy for controlling risks and relevant for some work held by the government is not necessarily shared by the workers. Similarly, the view held by the association that SWMS is a form of control and relevant for all construction works is not necessarily shared by the workers here. This suggests that the regulators are more likely to affect the way SWMS are used by the trades, not necessarily the association.

6.2.4 SUMMARY

This section discussed the findings of Organisation B. I have also compared and contrasted these various views, both within site, with organisational outsiders and with Organisation A. The diversity of views in the two residential building organisations and organisational outsiders are illustrated in Figure 23.

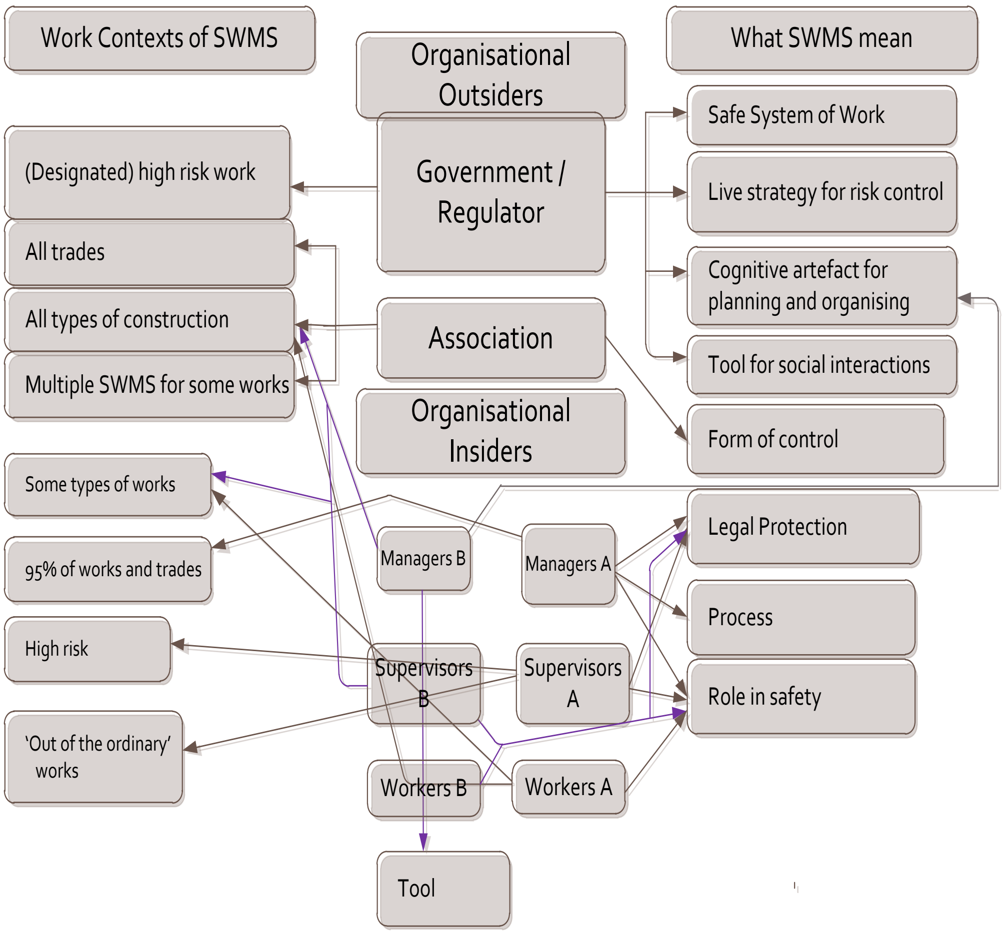

Figure 23: Summary of SWMS Views across Organisational Outsiders and Two Residential Building Organisations

6.3 ORGANISATION C VIEWS

Organisation C is a commercial construction services organisation based in Melbourne. It also has a considerable presence in Asia and has expanding operations in the United States. Its span of expert services include general contracting, construction management, project management, engineering, procurement and construction management (EPCM), design management and project controls. It employs over 400 direct employees and over 3,000 subcontractors from a wide range of trades; the mix based on the nature of the projects that is being managed. The company also has a dedicated health, safety, quality and environment management function that is staffed by a state safety manager, as well as a number of health and safety advisors. No specific health and safety advisor was appointed for the specific research site investigated in this research.

The specific research site involved a commercial project involving the construction of a three-storey multi-purpose building and its associated services. There was a range of works being undertaken at this site.

The first included the digging and laying of foundations. Initially these involved three workers: one excavator operator and two carpenters. As the work progressed, they were later joined by a workforce of over 60 others comprising a mix of trades, apprentices, skilled and unskilled workers.

The next steps included laying pipes for water and sewerage. This work was done by a group of six, including five plumbers and an excavator operator, and included drainage and excavation.

6.3.1 MANAGERS' VIEWS

The prescription of SWMS in Organisation C is based on interviews held with two key informants, and a series of documents (see Table 26). One informant was employed as the site manager while the other was a building coordinator; one held a TAFE equivalent diploma while another held a university degree. They held between six-and-a-half and 24 years of experience in construction, and had worked with the current organisation for between one-and-three-quarters and three-and-a-half years.

Table 26

Data Sources for Organisation C Managers

Participant	Position	Age	Education / Training	Experience in Cons	Length in Company
PAR030	Site Manager	XXX	City and Guilds Certificate	24 yrs.	$1^{3}/_{4}$ yrs.
PAR043	Building Coordinator	26	B Cons	$6^{1}/_{2}$ yrs.	$3^{1}/_{2}$ yrs.
Documents					**Version/Date**
Company Safety Policy					SAP-001 Feb 2010
SWMS Review Checklist – Victoria. Trade : Concreter Work task: Fixing steel re-inforcement					11.7.11
High risk task assessment worksheet					24.5.11

According to the managers here, SWMS: (i) were a legal requirement, (ii) involved a process, (iii) had a role in safety and (iv) was relevant for all construction work.

6.3.1.1 SWMS Provide Legal Protection

A common view that was expressed by managers is that SWMS are a legal requirement, as shown in the following excerpt:

'Obviously it's a legal requirement as well and it covers my #X% to make sure there's a method statement in place because it's the law'. PAR030*

He goes on to provide a rationale for this view:

'I think the higher you go up, it becomes more of a legal obligation, because they want to protect the workers, but they need to protect the company and the corporation as well'. PAR030

The clarification here suggests this certainly was the case the higher one went up the management chain, so having a SWMS meant the company and the corporation were meeting their legal obligations.

6.3.1.2 SWMS are a Process

A second theme from Organisation C is that SWMS are a process, as reflected in the following excerpt:

'It's a review. It's a review process'. PAR030

For this informant, SWMS involved a review process. He suggests what the review process was about:

'It's a process of risk assessment first, and control of that risk assessment. And a logical step, procedure and carrying out the jobs, that's the way I tend to look at things'. PAR030

For him, SWMS is about a process of risk assessment, which involves following a logical set of steps or procedures. He goes on to provide an example of how this is expected to work:

'If you've got to do this job, erect fences, what's the risk involved with erecting fencing? What's the sequence of work involved, what tools, so on, machinery, is going to be of use'. PAR030

In the above case, he would look at the job, the risks of doing that job, the steps, tools, and equipment that is necessary to get the job done. The SWMS would assist him in thinking through the process. In this case, there is no risk from erecting fence itself, but with any equipment being used.

Another informant discusses SWMS as a review process in the following way:

'SWMS … I mean, it's a review of tasks'. PAR043

For this informant, SWMS is about reviewing the tasks.

6.3.1.3 SWMS Have a Role in Safety

A third common theme suggested that SWMS had a role to play in safety, with one informant describing it in the following way:

'It's designed to ensure that the work's carried out in a safe manner without harm or injury. That's what it is'. PAR030

He goes on to provide a rationale for this perspective:

'Ensuring that these SWMS, a lot of, especially the older guys, are in the mindset that SWMS is just a bit of paper and a waste of time, so … It's a matter of education, isn't it? If you can educate the guys to saying, look, this is the SWMS, we, as in your manager, or myself, have sat down and thought about what the hazards are, what the risks are, this is how we're going to control them, then that should help achieve it'. PAR030

SWMS in this case is used to communicate with the trades the fact that they have had a discussion with their supervisors, have identified hazards and agreed on controls, and this can be used to provide an assurance to the trades that the work they are embarking on can be safe.

Another informant provides the link between safety and SWMS in the following way:

'An injury free workplace obviously is the number one goal'. PAR043

For this informant, again, the primary use of a SWMS is to create an injury free workplace. He goes on to provide a rationale for his thinking:

'Firstly, I guess it identifies the possible activities that are going to be a higher risk when being completed and then from that I mean you put in your standard control issues and then if at the end of those if the risk isn't reduced to an acceptable level, then you go back and repeat the process again'. PAR043

Here, as a process, SWMS assists in finding activities that may be a higher risk; standard control can be used, but if they do not produce the desired outcome of reducing risks to an acceptable level, the process has to be followed again. He describes this outcome in the following way:

'Your best first step is to try and eliminate it and before you substitute, put controls in'. PAR043

Part of the process to becoming injury free involves going through a hierarchy of controls using the SWMS process. While this hierarchy chart is used to arrive at the decision about the adequacy of control, what is acceptable is not as clear cut:

'For higher risk tasks that goes all the way up to—I develop that down to and then that gets reviewed by … my bosses, for higher risk tasks. For general SWMS, that probably stays with the site manager and develops with the company [subcontractor]'. PAR043.

What is deemed to be adequate control according will be based on decisions at two different levels. For higher risk tasks, this is expected to involve more senior managers who are based off-site (head office), while for other tasks this involves the site manager and subcontractor.

6.3.1.4 Work Contexts for SWMS

For Organisation C, SWMS are required for all types of construction work, a point that was made clear by one of the informants:

'Every task requires a SWMS'. PAR040

However, what appears to be different in this organisation compared to organisations A and B is that there will be two different types of SWMS, one for high risk work and one for 'others'. An informant explained the difference in the following way:

'If a painter's coming in to paint a skirting board, you don't look at that SWMS as much as you do if it involves doing a high risk activity'. PAR030

Thus, painting represents general construction work, and while a SWMS is required for that job, it is not as important as one that is more high risk. This informant explains what high risk work is about in the following way:

'I would say one of the most important SWMS for this job, which we're still going through the procedure of getting right, is for the formwork and the concreting of the slabs. That's the one that specifically involves the highest amount of risk'. PAR03

For this informant, the formwork and concreting posed the highest level of risk for the construction project they were undertaking. He provides the following rational for this thinking:

'Because you've got work at heights, you've obviously got manual handling risks, and placing steel-work at heights, placing concrete at heights. You've got cranes and pumps, and it's got to be done right, it can't be rushed'. PAR030

According to this informant, what made formwork and concreting high risk activities was the combination of normal hazards of construction work (work at heights, manual handling), complex work (steel-works and concreting at heights) and equipment on site (cranes and pumps). He goes on to explain other high risk activities on this project:

'Deep excavations, working at heights, there's various list of things, but you know, working with cranes is a high risk activity. I think high risk activity is something with the potential to cause severe harm or death, so that's confined space sort of things, you know?'. PAR030

Other high risk works include crane activity, working at heights and working in confined spaces. In his reflection, the informant also refers to high risk work as that had the potential to cause death.

Another informant talks about high risk work using an example to distinguish between concreting, precast and electrical work:

'Concreters don't really have too much high risk tasks. Precast is. Electrical is another one with obviously the energisation of their switchboards. They're the main ones that make it to the high risk tasks'. PAR04

In his view, concreting is not really high risk work, but working with precast concrete is, similar to electrical work. He goes on to provide another example, that of excavations:

'That's not really considered a high risk task. That doesn't fall under that category. The standard controls measuring them when they're completing the work is quite good. The chances of an incident becoming catastrophic is quite low so I think it only comes—falls into medium category'. PAR043

The thinking of this second informant appears to be in tandem with that of the organisation. This is based on a review of a 'High Risk Task Assessment Worksheet', which suggested that SWMS were required for tasks such as precast panels, concrete formwork and precast panel erection, but not necessarily for concrete pours and traffic management. However, what appears to happen is that once a job such as concreting occurs on site, it is treated as a high risk activity once the job starts. This is because while concreting itself may not be a high risk job, the introduction of concreting pumps and undertaking concreting works places it at the higher risk category.

In summary, then, SWMS are required for all construction works and from all. However, there appear to be two different classes of tasks, one for 'high risk' tasks, and one for 'others'. High risk tasks in this organisation appear to be based on a set list of tasks derived from that of the government and regulator, and an outcome of a risk assessment process.

6.3.1.5 Reflection-on-process

Earlier on, it was identified that one of the themes that emerged from Organisation C is that SWMS are a review process. However, a closer exploration reveals the review process appears to be different between tasks that are deemed to be high risks and those that are not.

'You don't have to review high risk tasks. I mean they get done at the start of the job and they're pretty much all encompassing, so there, if—they don't really miss anything because they get reviewed from job to job'. PAR043

According to this informant, SWMS for high risk jobs are reviewed before they commence work, and when the location of the job changes. Hence, they generally do not get reviewed while on a job. He provides a justification for why this appears to be so:

'They're pretty extensive'. PAR043

Hence, SWMS for high risk works do not necessarily get reviewed because they are developed prior to the commencement of the job, are extensive and generally cover most of what is required. The approach taken here appears to be consistent with the thinking of Swuste et al. (2012), the aim being to spend the greater efforts at the conceptualisation stage of the project. In essence, the focus here is likely to be around exampled and regular threats (Epstein, 2006). What can be missed, however, are the unexampled threats (Epstein, 2006; Westrum, 2006), and could leave the organisation vulnerable.

One trigger for revising SWMS is when there has been an incident. An example of this is discussed in the following excerpt:

'We had at the concrete pour back at the start of the month; we had an incident where one of the concreters received a splash of concrete in his eye. Obviously he was treated, it was washed out, no further medical attention was required. That was listed as a first aid incident. On review of the SWMS I did, he was working on the bullnose float,[34] which was working back from where the concrete was getting pumped out from so the SWMS didn't specify that he should wear safety glasses,—it's just an easier way to do it if they're all wearing safety glasses, so that was the recommendation I put forward … they've revised their SWMS'. PAR043

According to the above, an existing SWMS for concreting had been in place; however, this did not require all workers to wear eye protection. Because an incident occurred when doing concreting, the SWMS was revised to include the requirement for workers to use eye protection.

[34] The bullnose float is used to level out poured concrete,

6.3.1.6 Document Analysis

I followed this example through to see if there were any specific changes to the SWMS document itself. Extracts of the concreting subcontractor's SWMS for the activity of 'concreting' dated 6-7-2011 suggested, '*debris in eye'* is a hazard associated with pumping concrete, and *'correct PPCE*[35] *[Personal Protective Clothing and Equipment] to be worn, eye protection'* are required to be used. However, there are no such hazards for the step of 'bull float and hand trowelling', so no such protection is required. I tried to see if these documents had been revised following the incident; however, I did not see a revised copy during the period I spent collecting data at this site.[36]

Nevertheless, there is another SWMS that is used for concreting, titled 'placement of concrete in ground works'. Extracts from this SWMS is shown in Table 27.

According to this extract, *'eye injuries from splatter and dust'* are common hazards when placing concrete and trowelling and finishing steps of this task, and the risks for this are either *catastrophic or major* when assessed according to the risk assessment matrix used. In addition, the SWMS suggests that *eye protection was to be used for doing this job.* In some ways, this appears to contradict the understanding of one of the informants who believed there was no requirement to use eye protection for concreting works.

It may also suggest that the rules regarding eye protection is flexibly applied here.

[35] Personal protective clothing and equipment

[36] This does not necessarily mean the document itself was not revised. It is most likely that it had gone through some form of review, and the revised paperwork was somewhere between the main office of the principal contractor and the concreting contractor

Table 27

Extract of Hazards and Risk Control Measures—Concreting SWMS (Before Incident)

JOB STEPS	HAZARDS	RISK CONTROL MEASURES
Using Vibrator	Vibration Noise Debris in eye Fire, Burns Manual Handling Electrocution	• Job rotation and avoid vibration disorder • Vibrator to have muffler • Temporary barrier to be used to protect other workers in the area • **All PPCE[37] to be worn, eye protection,** hearing protection, hearing protection, heavy duty gloves, safety helmet, steel cap footwear, UV protection • All PPCE to be worn (as above) • No smoking in the work area of the vibrator • Re-fuel engine of vibrator when it has stopped and cooled, follow manufacturers operating manual • Fuel to be stored in appropriate container with fire extinguisher in close proximity • Operate in well-ventilated area • …

6.3.1.7 Summary

In the above section, views of SWMS from managers of Organisation C were discussed. What SWMS mean, the way they are developed and contexts of work they are expected to cover are summarised in Figure 24.

[37] Personal protective clothing and equipment

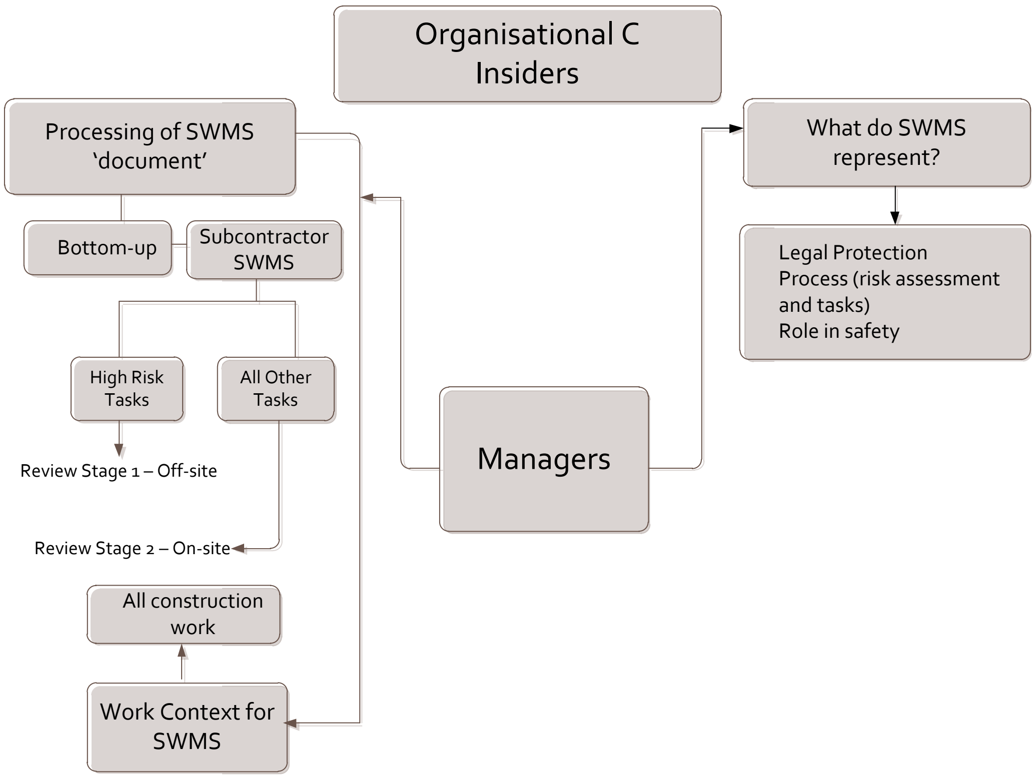

Figure 24: Summary of Organisation C Managers' Views

6.3.1.8 Comparisons between Sites

The views that SWMS provide legal protection by managers of this organisation are also shared by Organisation A managers. The review processes of SWMS in these organisations are also similar in that they are done internally. However, while managers of both organisations view SWMS as involving a process, what this is directed at are totally different. In Organisation A, the process is aimed at achieving efficiency, while managers here associate this as a review of the risks and of the tasks at hand. Similarly, SWMS are expected to play a role in safety, again the way this is expected to occur is different in these two organisations. In Organisation A, following SWMS as a set of rules is expected to bring about safety, while in Organisation C it is the review of controls, and educating and informing trades that assists in bringing about safety. The view here that SWMS are required for all construction work is also common to some managers in Organisation A.

This latter view is also similar to that held by Organisation B managers. The process aspects of SWMS among organisations B and C managers also have some similarities in that there is expected to be some level of focus on hazards, risks, controls and the work. However, while managers of both organisations suggest SWMS had a role in safety, the way this is expected to occur is different. In Organisation B, this comes about through interactions, similar to Organisation C (in terms of education and information); an additional way in Organisation C is through a review of the controls.

6.3.1.9 Comparisons with Organisational Outsiders

The four main views about the prescription of SWMS in this organisation are different when compared to the government and regulator. The latter see SWMS as a method of working safely, a live strategy for controlling risks for designated high risk construction works, a cognitive artefact for planning, and as a tool for social interactions; none of these are similar to the managers here.

Prescription of SWMS in this organisation is also different to the association that saw SWMS as a form of control; a view not necessarily shared by this organisation. The one common view of SWMS this organisation has with the association is that they are required for all works and trades.

There is a unique perspective about how SWMS and the review process are expected to occur here. If a high risk activity is involved, then the SWMS 'review process' involves higher levels of management. Conversely, if the works were deemed not to be high risk, then this review would be done at site level. The understanding of high risk, however, is not confined to the list of activities suggested by the government and regulator but also includes things such as manual handling and extends to those that may be 'ranked' as catastrophic using the organisation's risk assessment matrix.

6.3.2 SUPERVISORS' VIEWS

The perspectives of Organisation C supervisors are based on an analysis of data collected from two key informants and triangulated with copies of SWMS for excavation, formwork, placement of concrete on ground, concreting and fixing of steel reinforcement (see Table 28).

Table 28

Data Sources for Organisation C Supervisors

Participant	Position	Age	Education/ Training	Exp. in Cons (yrs.)	Length in Company (yrs.)
PAR032	Foreman	31	Year 12 / TAFE	12	1 ½
PAR036	Leading Hand	40	Year 10 / TAFE	20	1
Documents				**Version / Date**	
Subcontractor SWMS - General Excavation				6.7.11	
Subcontractor SWMS - Formwork				6.7.11	
Subcontractor SWMS - Placement of Concrete in Groundwork				6.7.11	
Contractor SWMS - Concreting				6.7.11	
Contractor SWMS - Fixing Steel Reinforcement				6.7.11	

The two informants comprised a foreman and a leading hand, who were aged between 31 and 40 years. They had worked in the construction industry for between 12 and 20 years, with one to one-and-a-half years with their current company. Common themes that emerged here suggested that SWMS: (i) provided protection, (ii) had a role in safety and (iii) was a tool. According to them, SWMS were revised in case of an accident, and the changes would form part of the documentation. In addition, monitoring of SWMS is aimed at enforcing its use on site.

6.3.2.1 SWMS Provide Protection

According to one supervisor, SWMS provides some level of protection, a point he made in the following way:

'Personally, I think they're more to put the onus on the worker, put it … well, suppose it's a double edged sword: it protects the worker, and it protects the employer'. PAR032

He believed that SWMS provided a two-way protection, to the workers as well as the employer. When asked to explain how, he replied in the following way:

'It protects the worker by they should've gained the knowledge to do things a correct and safe way'. PAR032

What he is suggesting is that SWMS act as a source of knowledge for doing work in a correct and safe way, which could be interpreted to mean following the rules that form part of SWMS.

In terms of providing protection to the employer, he offered the following explanation:

'Employer? Well, they're shown to be training their blokes, which is a requirement'. PAR032

He saw having a SWMS as a form of evidence that the company was training its workers, something it was required to do.

Another supervisor discussed the links between SWMS and protection in the following way:

'In some of the SWMS, what they do is they cover—most of them cover a broad spectrum of work, and then some of those methods in the SWMS—certain parts of the building crews won't be doing that particular work, but they'll be doing other parts of that which is covered. So you never—sometimes you might get a generalised SWMS that covers different aspects for different crews that are doing different work. Like the steel fixers, they'll be covered by a certain part of it. But they necessarily won't be doing the work that carpenters are doing. And concreters, they'll be doing different work, so sometimes you get a broader view SWMS that basically covers everyone on site'. PAR036

What the above informant seeks to suggest is that SWMS could act as a source of 'redundancy' (Hopkins, 2009; Weick, 2007, Weick et al, 1999). In engineering terms, redundancy is about having duplicates and back-up controls for system components that are most likely to fail (Weick et al., 1999). In the above case, there may be multiple SWMS involved because there are different crews involved, who may be exposed to hazards from their work, as well as from those who are working nearby. This happens frequently as construction work picks up. The informant uses the example of workers fixing steel (reinforcement of concrete) who would generally not be aware of the hazards associated with concreting if this is being done on the site at the same time, so giving them a SWMS for concreting not only enables a second set of observations but also duplicates and enables a back-up strategy to be put in place. Therefore, the SWMS for concreting acts as a form of redundancy.

6.3.2.2 SWMS Have a Role in Safety

There is a view among some of the supervisors that SWMS have a role in safety, with one supervisor explaining the link in the following way:

'To make sure that everyone's aware of site-specific safety requirements, and also our safety requirements as far as putting up the tilt panels and doing our crane work as well'. PAR036

In this case, he sees the SWMS as something that makes everyone aware of specific hazards and ways of putting up tilt panels using cranes safely. He goes on to add:

'Just to make sure everyone's safe and everyone's all working together, and then everyone knows what everyone's doing'. PAR036

In this second excerpt, he is suggesting that the SWMS keeps everyone informed about what is going on. When asked to explain this thinking, he provides the following:

'So it's procedures that are basically in place so that everyone knows what are the procedures and if any changes are to be made to site-specific jobs, then everyone knows about those changes before we actually go and do the work'. PAR036

His explanation is that SWMS lay down procedures that are expected to be followed; SWMS acts as means of communicating any changes. Asked to explain how he saw this as assisting in improving safety, he offered a further explanation:

'Basically, a safe guideline that everyone that's involved in the toolbox meeting is aware of that certain procedure is to be followed … But it's a set of guidelines to make sure everyone's safe, everything's done in a safe way, that it's all been pre-planned that everyone understands and knows about, so that nothing's changed that no one else knows about'. PAR036

This suggests SWMS act as a guideline to be followed, which will generally be agreed on through a toolbox meeting. Because the SWMS has gone through a preplanning process, it will assist in bringing about safety.

6.3.2.3 SWMS are a Tool

While the two supervisors shared a range of views about SWMS, a common theme that arose from the interviews suggests it was a useful tool of the construction trade.

'It develops a basic format, I think, for everyone to adhere to, a planned and pre-organised way of doing basically the work to be performed on the site'. PAR036

According to the above excerpt, one use of this tool is for planning and organising how work is to be done. He goes on to provide an example:

'As you can see, the area where we're working, so we've got a clear workspace there's no interference, so we've got free access and easy movement, there's no trip hazards, there's no fall hazards, there's nothing to slip on, and that's just like the start of your pre-work check. Make sure everything's clear, your area's clear, then you know no one's going to fall over when you've got a panel coming in and you're lifting something in. That's just one part of it, but then you've got to make sure your area's like you said, like you can see, is barricaded off so no one—everyone on site knows that red tape: don't come in this area when we're lifting panels in case something falls over. So that's designed for that, so there's that to coordinate'. PAR036

According to the above excerpt, SWMS triggered some of the thinking about the work, what threats and hazards were likely to exist, and what type of controls would be needed to address them.

Another way it was useful was as a training tool for apprentices, as the following excerpt suggests:

'SWMS is probably more for apprentices and staff that come on, gives them a better understanding and what goes on. A lot of the older guys already know what's going on'. PAR036

For this informant, SWMS were useful in giving the apprentices a better understanding of what was occurring on site. Because most of the other workers were older (hence, more experienced), he believed SWMS may not necessarily be as useful for them.

6.3.2.4 Revisions and Changes

In seeking to understand the supervisors' experience with SWMS, it became apparent that both were involved in developing and reviewing them. One informant shared a recent experience he had gone through:

'For instance, we've just amended our concreting SWMS today, because on Saturday someone got some concrete in their eye and it was while they were doing a task that didn't require glasses. So now we've amended the SWMS so whenever anyone does that particular task, they have to wear safety glasses'. PAR032

In this case, an incident appears to have caused a 'breakdown' in the way things were done (i.e., concreting without using safety glasses), and this acted as a trigger for revising the

SWMS and finding newer ways of working (the need to wear safety glasses next time concreting is undertaken). This informant suggests the lessons learned in this case will be carried over to the next SWMS:

'So on the next site, the next site it'll be on that SWMS'. PAR032

According to Nathanael and Marmaras (2008a, 2008b), for this change to be accepted as part of the normal work, it needs to be re-enacted and assimilated as part of the repetitions cycle. I tried to identify if the SWMS 'documents' had been changed. This had not been done by the time I had finished collecting data from this site. However, I did observe that all trades who were involved in concreting works since the incident did have eye glasses on, on about three different occasions following the incident.

6.3.2.5 Monitoring of SWMS

The uses of SWMS are monitored on this job by the supervisors. One of the supervisors discussed what this entailed in the following way:

'But I suppose enforce them as foreman; [as does our rep] if I see someone who isn't complying by something, I will go and give them a little reminder to put their glasses on, put their hat on whatever'. PAR032

What the above excerpt seeks to suggest is that SWMS are used to monitor the use of safety gear. Another informant explained it this way:

'See if the [OHS officer] comes in, he wants to know how we're going to do it. Where we're doing it, who's in control, who's the relevant people licensed or ticketed to do that job or be in charge of that particular work. So it encompasses all those facets of the SWMS'. PAR036

This informant suggests it can also be used for monitoring if work is being done in accordance to the SWMS. This includes knowing where the work is being done, who is responsible for the work, and the competencies of people engaged to do the work. What appears to be suggested by the informant here is that SWMS established a higher-level of scrutiny than was the norm.

6.3.2.6 Anecdotes from the Field

In this research site, I participated in two weekly safety audits. This was done by a health and safety committee, which was made up of the CFMEU nominated HSR, the site manager, and a representative from the three main contractors, including a plumber, concreter and an excavator operator. This was done at 2.30 pm on a Tuesday. The safety audit included a walk-through of the ground and first levels of foundation works to observe how things were being done. The audit team did not have a fixed checklist of things to go through on my first audit, but I observed that particular attention was being paid to whether PPE (such as safety vests, eye glasses and safety shoes) were being worn, whether the temporary roadways for transporting material and removing soil from the foundations were being kept clear, whether the log-books for the excavators were being filled in, and whether the 'site safety board' was up-to-date.

During the first safety audit, the committee identified that a square hole about 900mm deep beside the portable block used by electricians was not barricaded off. This started a conversation, led by the site manager, regarding why this had not been done. The discussion centred on when the rules for this had been changed (from 1500mm to 900mm), and why this was not communicated or picked up in the previous week. In all, this audit took about 12 minutes.

This was followed by a 'health and safety team meeting' led by the site manager. This meeting discussed what had been covered at the previous week's meeting and progress on issues. One of this was the results of the atmospheric testing for digging near the underground services, where a report was still awaited, so that section of the work was not proceeding. New topics covered included the finding about the unprotected 'hole in the ground' and what they believed should be the criteria for a weekly safety award for the site. This latter was an initiative of Organisation C, which ran such a competition at all of its commercial sites. This meeting concluded with final words from the site's HSR, who briefed the crew on current enterprise bargaining agreements being handled by the CFMEU.

A second audit was undertaken a week later. This was held on a Thursday due to no work being done on the Tuesday because of weather conditions.[38] In the last two days, more

[38] Under the EBA signed for this site, construction work ceases when it has been raining for three hours, and this had occurred on Monday and Tuesday.

concreters, electricians and plumbers had been employed, so the safety committee was increased to six. This round of auditing lasted about 22 minutes, more questions were asked, and this times not only by the site manager but also by reps from plumbers and excavators. The questions discussed as part of the audits appeared to centre on whether single-colour safety vests were appropriate, and how safety issues across the three work boundaries were to be handled. This latter point was discussed at the health and safety meeting following the audit. The issue of barricading the open 'hole in the ground' was again discussed, this time the focus being on who was responsible: the electricians who were housed close to the hole, or the plumbers who had actually dug up the hole. Again, this issue was discussed at the health and safety meeting.

The observations suggested that the focus of the monitoring of the work during the safety audits was more of a general safety inspection. SWMS did not appear to be a focus at these two weekly audits.

6.3.2.7 Summary

The above section discussed the views of supervisors, which are summarised in Figure 25. The revised SWMS document is not completely encapsulated in the illustration because while the practice of wearing glasses had been accepted, the document had still not been revised to capture this.

6.3.2.8 Comparison within Site

There are a number of similarities, as well as differences, the supervisors have with managers of this organisation. Both view SWMS as providing legal protection to workers and the organisation and playing a role in safety. The supervisors, however, believed this protection was not limited to legal issues but was also a means of redundancy, by making the different crews on a site aware of additional hazards and controls, some of which they may not be directly exposed to but could still be subjected to because other works were also being done. The views that SWMS were a process and relevant for all construction work held by the managers were not shared by the supervisors here.

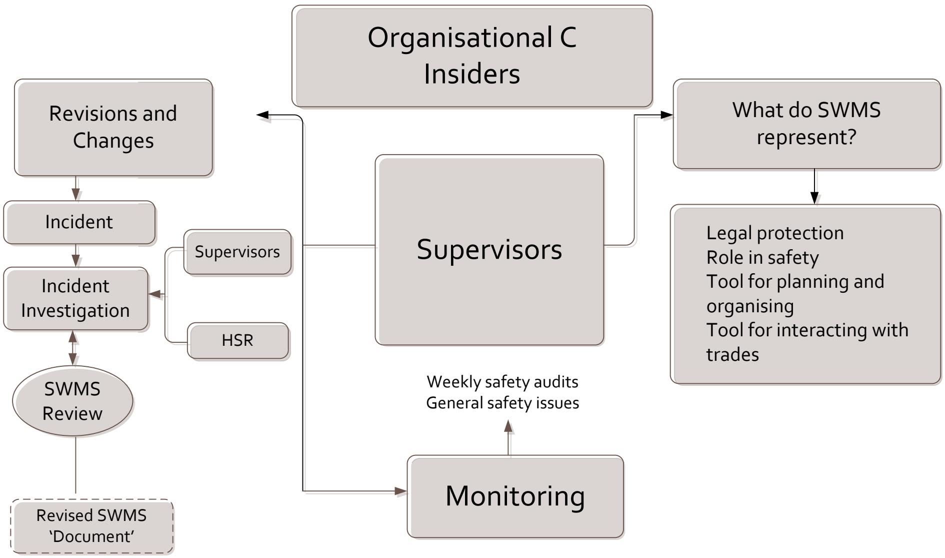

Figure 25: Summary of Organisation C Supervisors' Views

6.3.2.9 Comparison between Sites

There are some similarities, as well as a number of differences, between the supervisors of the three organisations. For example, the view that SWMS provide legal protection and have a role in safety is common between all three organisations. However, the view according to Organisation A that SWMS were relevant for some work is not shared by Organisation C. Similarly, the mixed views suggested by Organisation B supervisors about the types of works for which SWMS were relevant to were not necessarily shared by Organisation C.

The ways SWMS were revised and handled were also different across the three organisations. In Organisation A, supervisors may be involved in making changes, but these did not necessarily mean a change to the way things were done. This is different in Organisation C, where the supervisors are actually involved in making the changes and seeing the changes in practice.

The monitoring effort of SWMS is also different across the three organisations. For example, in the first, supervisors appear to be directed at monitoring the paperwork; in the second, the monitoring looks at both the completion of paperwork and the physical presence of the document, while in the this third organisation, the monitoring efforts appear to be aimed more at enforcing the requirements and rules as stipulated.

6.3.2.10 Comparison with Organisational Outsiders

A number of similarities and differences are apparent between the government/regulator and supervisors of this organisation. The view held by the supervisors in this organisation of SWMS having a role in safety and being a tool for interacting is also common to the government and regulator. However, the supervisors did not suggest what types of construction works they were relevant to, and this appears to be one of the main differences between these two groups across the system. Similarly, the understanding held by the supervisors here that SWMS provides legal protection is not shared by the government and regulator.

No similarities were apparent in the views between the association and the supervisors of this organisation.

6.3.3 WORKERS' VIEWS

Organisation C's workers' views are based on an analysis of interviews held with 15 key informants (see Table 29). Four were licensed excavator operators, two were employed as carpenters, four as plumbers, two as riggers, one as a concreter and another as a labourer and OHS representative. Most had completed schooling ranging from years 8 and 12, while a few had also completed TAFE training. All machine operators held high risk work licences, and had been employed in construction for four months to 30 years. The workers had been with their current employer for between three weeks to four-and-a-half years.

The three common themes that emerged here suggest that SWMS: (i) provided legal protection, (ii) involved a process and (iii) had a role in safety.

6.3.3.1 SWMS Provide Legal Protection

A common theme among the workers here was that SWMS provided them with some level of legal protection, as is evident in the following excerpts:

Table 29

Profile of Organisation C Workers

Informant	Position	Age	Education/ Training	Length in Const.	Length in Company
PAR026	Health and safety rep	38	Year 12	17 yrs.	5 wks.
PAR027	Excavator Operator	XXX	Year 10 / HRW Licenses	30 yrs.	23 wks.
PAR028	Plumber	XXX	Year 10 / TAFE	5 yrs.	4 ½ yrs.
PAR029	Plumber	XXX	Year 10 / TAFE	5 yrs.	4 ½ wks.
PAR031	Carpenter	46	Year 10 / TAFE	30 yrs.	4 wks.
PAR033	Rigger	41	Year 10 / HRW Licenses	10 yrs.	1 yr.
PAR034	Rigger	38	Year 12 / HRW Licenses	20 yrs.	1 yr.
PAR035	Crane Operator	28	Year 10 / HRW Licenses	15 yrs.	1 yr.
PAR037	Mac. Operator	29	Year 10 / HRW Licenses	5 yrs.	5 yrs. 8 months
PAR038	Excavator Operator	30	Year 8 / HRW License	4 months	4 wks.
PAR039	Plumber	23	Year 12 / TAFE	5 yrs.	3 wks.
PAR040	Apprentice Plumber	21	Year 12	4 yrs.	4 wks.
PAR041	Machine Operator	32	Year 10 / HRW Licenses	6 ½ yrs.	6 wks.
PAR042	Concreter	44	Year 10	24 yrs.	9 months

'So they're a legal requirement'. PAR026

'But it's just, these day, everybody's covering their #@@ so they don't get into trouble'. PAR027

'I think it's a legal requirement now'. PAR027

When asked to explain how SWMS assisted in providing such protection, the following were some of the responses:

'If something goes wrong, the company here [Organisation C], they can say, well, you didn't fill your SWMS out properly, so it's your fault'. PAR027

According to this informant, if an incident occurred while he was working for this particular company, the SWMS would protect Organisation C (instead of him), so it was about a shift of blame onto the user, a point he makes clear in the following manner:

'We've got a job to do, we know how to do our job. We do it as safely as we can. Nobody wants an accident, so I think the paperwork in general is just a blame shifting thing. That's my belief'. PAR027

Others explained the link between SWMS and protection in the following way:

'It's protecting you and the people around you'. PAR037

'Just to protect everyone from hurting themselves, getting everyone aware of safety, so if any work … like stop you from suing the company for not making a safe work site'. PAR040

Here the informants believe SWMS set about the right and wrong ways of working, providing a two-way protection. One is to do with safety, and this is by making people aware of safety. The other is a form of legal protection from insurance and/or compensation if SWMS have not been followed.

Getting people to sign on the SWMS was one form of legal protection for this company, as was evident from a number of informants:

'Or they can say, well, you've signed the SWMS so you know what the problem was, so it's still your fault'. PAR027

'If you sign it, you were going to do the work safely. Like you wrote all the terms to your JSA and you had to follow them'. PAR040

'Because you had to write down the terms on your JSA, like the way that you had to work safely, they make you write the JSA, you don't just sign the JSA'. PAR040

According to these workers, because they have signed onto SWMS, they were liable to be at fault if they did not do what was suggested in the SWMS. There was no point in signing them if one did not intend to follow them.

6.3.3.2 SWMS Involve a process

Another common theme that emerged from the workers was that SWMS involved a process, as the following excerpt seeks to suggest:

'We fill that out on our SWMS before we start the job, and on a few jobs I've been on, you'll do a SWMS for one area, and then when you move to another area, you have to do another SWMS, even though it's the same work, they want it revived again'. PAR027

Here the informant suggests the process involved 'filling in' of SWMS, which was repeated as he moved from one job to the next, even if the site was the same. Others expressed similar views:

'Every time, they always … It doesn't matter if you go on to a different job, they could be exactly the same SWMS, but you still got to read through them. They put them in front of you to read through them again and make sure you're aware of all the same dangers'. PAR028

'You've got to sign it so just to say that you have read it, and then sign it'. PAR029

'We all sit down as a team and work through things and make sure things are going to happen safely'. PAR035

According to the above excerpts, processing SWMS included a number of interactions involving:

i. the document and the worker *(e.g. reading, signing),*

ii. work and hazards *(e.g. working out what to do),*

iii. groups of workers themselves *(e.g. discussing what's going on, toolbox)* and

iv. The workers and someone in authority *(head engineer or whoever's in charge).*

These interactions that occur in the processing of SWMS provide the basis of social construction of safety (Gherardi & Nicolini, 2002a; Gherardi, Nicolini, & Strati, 2007). Further examples of this are demonstrated in the following:

'The blokes that I'm working with, if they're not happy they're not going to work properly down in the trench. I don't blame them; if they say, 'Look, there's something wrong with this trench,' it's not for me to say, oh, don't be a wuss,

just do it, I've got to say, well, all right, we'll fix the situation. Make it so you're happy to do your job. Because the last thing you want is for something to wrong and then suddenly they say, well, you said it was all right. So yeah, we identify the problems and fix them as we go'. PAR027

Here the informant is of the view that this interaction involves a two-way exchange of concerns that result in an agreed course of action. The outcome of safety is something that is continuously negotiated as the work proceeds:

'As we're working on it, we assess everything as we go, and what's dangerous, what's not dangerous, and work it out from there sort of thing'. PAR027

For others, the process involved agreement about the work and how it is to be done:

'The only thing I've had to do is read them and agree to them and then make it work to what I've signed'. PAR037

This informant suggests reading the SWMS, agreeing to it and making sure he works in accordance with it are part of this agreement; it is his signature on the document that is most likely to hold him accountable to what he does or does not do. However, as discussed above, because he has been actively engaged in the process, he is able to work in accordance to the SWMS.

6.3.3.3 SWMS Have a Role in Safety

According to some workers, SWMS had a role in safety; examples of this view are evident in the following excerpts:

'To do the job [effectively and] safely, minimise accidents and injuries in the workforce'. PAR026

'Safety, I suppose, at the end of the day'. PAR028

'Do it safely'. PAR029

When asked to explain what this meant, one explained it this way:

'The concreters… just a ground floor slab, footings, ground floor slab and in this instance here, it's suspended slabs, so that'd mean they've got to introduce use and need of formwork. It encourages obviously falls from heights and a lot of other risks, so you have to have a look at everything'. PAR026

Through an example of SWMS for concreting, he suggests that because the work involved installing suspended slabs that needed to be supported, this created the need to provide additional formwork. This work also introduced new hazards of falling from heights, and the original SWMS they were required to use provided him with a way of moving forward.

Others emphasised the link between SWMS and safety in the following ways:

'It is to identify problems on the job and what can go wrong and that sort of thing…Making sure we can identify all the hazards, such as deep trenches, machinery, and stuff like that, and ensure what we can do to make it safer and a better job'. PAR027

'Through identifying the possible hazards and trying to eliminate those possible hazards…To prevent any injuries to their personnel'. PAR031

These informants saw SWMS being useful in identifying hazards and problems of a job, as well as what control measures were in place for controlling those hazards. Others explained it this way:

'The way we lift things, the way we put things in place, make sure when we're doing overhead lifts that certain areas are barricaded off so we haven't got pedestrian traffic through. Vehicles—clean where we're working'. PAR034

'As long as everybody reads through it and agrees with it and signs it, and takes note of what the SWMS says, then it should be fine'. PAR039

'It explains what you can and can't do on site. What safety methods are used and stuff like that'. PAR042

For the above workers, it provided a set of guidelines for what could and could not be done on site, ways of working, and getting one to think about the safest way of doing the job at hand.

The above section has discussed the views workers have of SWMS in Organisation C. The three common views here are that SWMS provided legal protection, involved a process and had a role in safety.

6.3.3.4 Anecdotes from the Field

While in the field I observed a number of construction activities over a period of eight weeks. These works included excavations and plumbing works. The main trades involved in these works included concreters, excavator operators and plumbers (including apprentices).

One of the works I observed being done here included slab foundations. This work was initially done by three people, two of who were excavator operators but one was employed as a labourer, and another as a carpenter. Similar to the observations I had made in

Organisation A that involved excavation works for drains and plumbing, I also observed that the carpenter and labourer continued to stay and work close to the buckets, less than half a metre away. As discussed previously, working in such close vicinity is not encouraged unless a clearance zone of at least two metres in and around the excavator is provided (Safe Work Australia, 2011a; 2011b); however, this was being bypassed most of the time.

The difference between this and the first site where I observed a similar task being undertaken was that this site was a unionised site, a HSR had already been appointed, yet the practice continued. Here again a combination of hand gestures and eye contact between the excavator operator and crew was maintained throughout the duration of work.

What was also different here was that the signals had not been pre-arranged the first time the team worked together on the site. Again, a deep sense of trust between the excavator operator and the workers enabled the slab foundation works to continue.

The way in which similar excavation work was done by the plumbing team, however, was a bit different. I observed that this team similarly worked very close to the buckets, as illustrated in Figure 26.

Figure 26: Excavation works for plumbing on a commercial construction site

What was different with this work was the plumber's healthy respect for the excavator, which saw him stand away as far as possible as he could from the buckets. On most occasions, the excavator operator commenced the digging when the plumber was at least 2 metres away, and in his direct sight. Once he had done his bit, he moved the bucket away, thus allowing for the plumber to do his work. After the plumber had set in the pipes and shovelled in some gravel, sand and soil, he moved a safe distance away, a gesture that meant the excavator operator returned to complete his work. In discussions with the plumbing team, I noted the excavator operator had previously held a discussion and laid down his rules about how things were going to work, and I noted that the JSA he carried with him suggested he needed to ensure everyone had safety vests on, were within his site and a minimum distance of 2 metres was to be provided between the bucket and any workers nearby.

An episode that occurred on site was the ceasing of work when it started raining. This occurred on at least four different occasions while I was on site. Once it started raining, all tools were downed; workers gathered in the foyer of the temporary sheds, young and old, from all trades, using the time to have a cuppa, share in a joke or have a go at someone. A window of three hours was allowed before the workers packed up for the day, in accord with the Enterprise Bargaining Agreement (EBA) award that operated on the site. In this instance, a proactive response arising from rainy conditions meant workers were not exposed to a health and safety issue.

I noted that the SWMS for a number of activities used on this project made no mention of the fact that changes in weather conditions would be potential hazards. It can be argued that it was the EBA that encouraged the workers to escape from the impending threat on this particular site. From a RE point of view, however, this demonstrated that safety could not be bypassed in favour of production, even though this was not the case when working in close vicinity to the excavation works for the slab excavations.

6.3.3.5 Summary

According to the views of the workers in this commercial builder, SWMS acted as a form of legal protection by pointing out how work was to be performed safely and by getting them to sign the document. In addition, SWMS was also a process associated with paperwork that indirectly resulted in interactions involving the document and worker, the work being done and the hazards of the work, and the worker and someone in authority. SWMS also played a role in safety by making one aware of hazards or problems on the job and enabled workers to think about the safest ways of completing a job.

6.3.3.6 Comparisons within Site

There are some similarities and differences about what SWMS means to the workers here compared to the managers and supervisors of this organisation. For example, all groups believed that SWMS provided legal protection and had a role to play in safety. Moreover, both managers and workers here saw SWMS as a process; however, this view is not necessarily shared by the supervisors.

The view of SWMS being relevant for all types of construction work according to the managers is not shared by the supervisors or workers here. Similarly, the view of SWMS being a tool held by supervisors is not necessarily held either by managers or the workers here.

6.3.3.7 Comparisons between Sites

Similarities and differences about what SWMS means to the workers here compared to the workers of the other two organisations are also evident. For example, workers of all three organisations believed SWMS had a role in safety, and in similar ways. However, the mixed understanding according to Organisation A workers of types of construction works to which SWMS were relevant to were not shared by the workers here. Similarly, the view held by Organisation B workers that SWMS was a tool for identifying hazards and a guide for working safely and decision-making is not held by the workers here. Similarly, the view held by workers here that SWMS provide legal protection or involve a process was not held by workers in the other two organisations.

6.3.3.8 Comparisons with Organisational Outsiders

Some similarities and differences about what SWMS means also exist between workers here compared to the government and regulator. For example, the views that SWMS had a role in safety are common across the two groups of informants.

However, the views according to the government and regulator that SWMS were relevant for some types of construction work and were a live strategy for controlling risks are not shared by the workers here. In a similar manner, the view held by the workers that SWMS provided legal protection and involved a process is not shared by the government. The workers here did not share any views of SWMS that were similar to the associations. This is suggestive that the workers' views of SWMS in this organisation appear to be influenced more by the government and regulator than the association.

6.4 SUMMARY OF KEY FINDINGS

The diversity of views in relation to what SWMS mean across the socio-technical system I investigated has been presented and analysed in Chapters 5 and 6 and summarised in Figure 27.

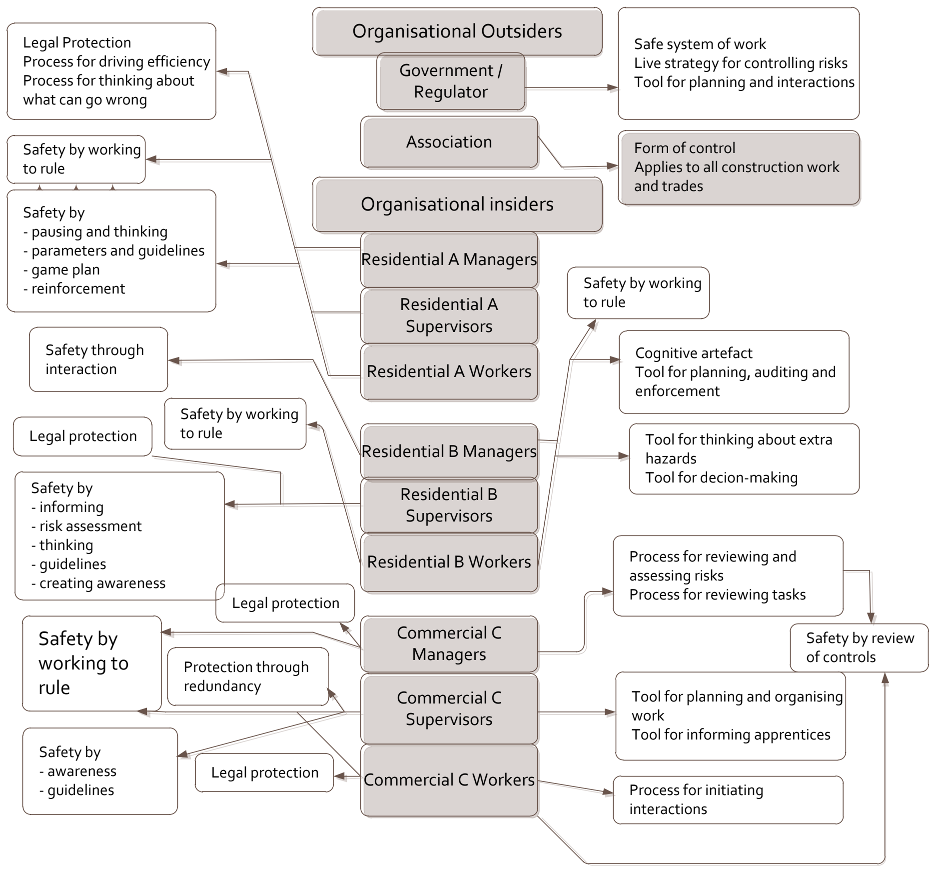

Figure 27: What SWMS Mean across the Construction Socio-technical System

In the next chapter, I discuss these findings.

CHAPTER 7: DISCUSSION

7.0 INTRODUCTION

The last two chapters presented and analysed the data collected through multi-level case studies. The findings enabled me to develop a comprehensive and rich picture of how SWMS are viewed across the socio-technical system investigated. Before seeking to discuss what the findings mean in relation to my research and sub-research questions, I believe it is important to be aware of the limitations of this study, and the utility of the theoretical approaches I employed to inform this thesis.

7.1 LIMITATIONS OF THIS STUDY

As with most research studies, this study has a number of limitations. In Section 3.4, I outlined some of these as weaknesses associated with the four methods of data collected in this study. In essence these include: (i) researchers could be fixated on details that may be unnecessary, (ii) cultural differences may cause difficulties in interpreting the data, (iii) data can be affected by the researcher's presence, (iv) data are very dependent on the honesty and openness of informants, (v) findings are open to ethical dilemmas and (vi) findings can be difficult to replicate. In addition, case studies, as a research design and methodology, have their own limitations. In the main, this is about whether the results can be generalised beyond the research sites, largely because most case study research focuses on a single unit. The amount of description, analysis or summary material is up to the investigator (Stake, 2005).

The results and analysis are based on two domestic and one commercial construction organisations, so the results cannot be transferrable to other sites across the construction sector in Victoria or in Australia more generally. There was an uneven distribution of informants from across the three organisations. At the time of data collection, the federal government was in the process of rolling out harmonised laws, and this process included consolidations of construction safety regulations. Some of informants who participated were actively involved in this process, and this may have affected what they felt, said or believed. The way I analysed the data and identified the categories and themes is a reflection of my biases as a researcher. It may well be that others would have established a completely different picture altogether. At the time of finalising the thesis, the interview data was over 18 months old, so some of the views people held at that time may no longer be relevant.

Notwithstanding these limitations, this study has attempted to gain an insight into the way SWMS are prescribed and used in practice in three construction organisations located in Victoria. The insights have been drawn from a comprehensive multi-level research strategy using a triangulation of established data collection approaches for conducting qualitative case studies. The findings and analysis are based upon the experiences, beliefs and thinking of those involved in developing, deploying and using SWMS as part of their normal construction work, including managers, supervisors and subcontractors.

In seeking to understand whether SWMS enhance or impede RE, this study builds on the notion that 'the gap between work as imagined and work as performed' (Dekker, 2006; Hollnagel & Woods, 2006; Nemeth, 2006) was an important indicator of RE. A conceptual framework for exploring this gap was derived from the PRDD model (Nathanael & Marmaras, 2008a, 2008b) and used to refine the central research question into a series of sub-research questions.

The central research question: Do safe work method statements enhance or impede resilience engineering as a health and safety management strategy in the Victorian construction industry?

The research sub-questions:

1. How are SWMS prescribed, and how is such prescription interpreted?
2. How are SWMS experienced in practice?
    i. To what extent are the practices of SWMS repeated?
    ii. To what extent are the practices of SWMS re-enacted, and how may this be assimilated into a work-group?
    iii. To what extent are the practices of SWMS reinforced into a work-group?
    iv. To what extent are distinctions experienced in SWMS?
    v. To what extent does this distinction alter the practice of SWMS?
    vi. To what extent are the practices of SWMS formalised by a work group?
    vii. To what extent does a common description arise out of this formalisation?

In order to answer these research questions, I drew on systems and social construction theories to explore the prescription and practice of SWMS. Systems theory posits that organisations are one part of a broader socio-technical system (Rasmussen, 1997; Wiig, 2008; Wiig & Aase, 2007; Wiig & Lindøe, 2009). In this research, I have characterised this socio-technical system to include organisational outsiders and insiders of construction organisations (Pillay, Borys & Else, 2012; Rasmussen, 1997; Wiig, 2008). What this meant was that answering the research questions required me to extend my data beyond the four walls of an organisation. For this reason, I used multi-level case analysis (Wiig, 2008; Wiig & Aase, 2007; Wiig & Lindøe, 2009) to understand how SWMS were perceived across the different levels of the construction socio-technical system. Social construction theory suggests that safety is socially constructed (Gherardi & Nicolini, 2002b; Rochlin, 1999; Turner & Gray, 2009), while RE theorises that safety is an emergent property of a socio-technical system (Hollnagel et al., 2006). This thesis thus builds on the premise that safety arises out of social interactions that occur in the construction socio-technical system.

Two domestic residential and one commercial building project sites provided the context for this study, with interviews, document analysis and (a limited number of) observations used to collect data. The overall findings, presented and analysed in Chapters 5 and 6, reveal a complex and comprehensive picture of what SWMS are about and how they are developed, revised, changed, monitored and used in the three construction organisations investigated.

However, before discussing what these findings mean in the context of the research questions, I believe it is necessary to discuss the usefulness (or otherwise) of the theories that I used to inform this thesis.

7.2 THE EXPLANATORY POWER OF THEORIES

In this research, I used a number of theories, including the socio-technical system of organisations, social construction of safety and the PRDD framework, to develop an understanding of whether SWMS enhance or impede RE as a health and safety management strategy in the Victorian construction industry. In the following section, I briefly examine the explanatory power and usefulness of the above theories in informing this research.

7.2.1 SOCIO-TECHNICAL SYSTEMS THEORY

The use of a socio-technical system framework to explore the SWMS phenomenon was to understand the extent to which those involved in setting organisational policies and those expected to use them on a day-to-day conduct of construction work in the three organisations investigated in this study are likely to be influenced by factors external to these organisations. Previous authors who have used this approach, such as Wiig and Aase (2007) and Wiig (2008), suggest this approach enables researchers to study the effects of changes at the government level on the framework conditions of those at the lower levels who are exposed to those changes. While my thesis did not seek to explore any such changes, it did provide an ability to gain a much deeper insight into the conceptualisation and understanding of SWMS at the different levels of the construction socio-technical system.

Exploring the SWMS phenomenon across the socio-technical system, however, can raise a number of dilemmas. As Wiig (2008) has argued, overemphasising this perspective could cause a loss of knowledge at each level of the system, and an overemphasis of details at each level may mean a loss of the overall picture altogether. This means one has to set boundaries around the specific issues at each of the levels. In my specific research, my boundaries were around what SWMS were designed to achieve, how they were expected to be developed, changed and/or revised, and what was involved in monitoring them. My findings suggest it is a very useful framework for conducting research in health and safety in general.

7.2.2 SOCIAL CONSTRUCTION OF SAFETY

This thesis is built on the premise that safety is socially constructed (Cook et al., 2004; Gherardi & Nicolini, 2002a, 2002b; Rochlin, 1999) and arises from an interaction between hazards, trade-offs and work (Woods & Cook, 2006; Woods & Holnagel, 2006). For this reason, it aligns well with the theoretical framework of SI (Blumer, 1986; Charon, 2010). Using this framework enabled re-casting of some of the commonly used approaches and strategies associated with the management of health and safety (such as consultation and training) into a new light. This also enabled me to extend my thinking about how current approaches for managing safety could be understood better by using new language and ways of doing things. Previous research suggests that consultation on construction sites can be an issue (Walters, 2010); even when such a requirement is enshrined in safety law, it is debatable whether the consultation itself is meaningful (Ayers et al., 2012). Re-presenting this notion as a form of social interaction is my way of bringing academic research on safety a step closer to the industry, through the use of common language and symbols that may not sound as 'legalistic'. While other researchers will, no doubt, continue to undertake research on construction health and safety using other established approaches, the results of my study suggest that seeing safety as a social construction provides both the industry and academics the opportunity to build synergies between research and practice, and is, therefore, another useful tool for health and safety research.

7.2.3 THE PRDD FRAMEWORK

The PRDD framework was used to understand the different meanings inside the three organisations assigned to SWMS and the objectives they aimed to achieve, as well as to give an insight into how they are actually used. This has been suggested as a useful way of gaining insight and steering the co-adaptation of cognition-organisation-technology that follow technological or organisational changes (Nathanael & Marmaras, 2008a). While my thesis did not seek to explore any co-adaptation as such, it did provide me with a lens through which I could delve deeper and understand both the prescription and actual practice of SWMS at a more micro-level of analysis. According to Nathanael and Marmaras (2008a), the practice of work pointed to a macro-level of analysis in two main ways. The first involved a larger time frame because of its emphasis on repeated accomplishments and historical development, and the second concerned more than one individual and team. Hence, the analysis at the macro level is needed to take into account both the development in time through learning, the work settings and the how collective activities were shared or distributed among the different players at the level of work (Nathanael & Marmaras, 2008a). However, at the micro-level of practice, RIA and ROA have been suggested to play an important role in the development of practice (Schön, 1983). The first of these actions, according to Schön (1983), was an on-going experimentation that assisted in finding a viable solution for things that did not appear to work and involved a conscious activity when a surprise appeared in the process of accomplishing a task; the second involved thinking back on what one had done to understand actions taken based on what they knew could have contributed to an unexpected outcome.

Exploring the SWMS phenomenon using this conceptual framework did pose a number of dilemmas for me. In the types of work activities I observed, such as roof plumbing and tiling, excavations and drains, while being a recursive set of activities in the industry, lasted between two to three days, so I had limited opportunity to observe the work itself. The PRDD suggests there are distinct cycles in the practice of work. Even though this may exist, it was difficult to identify when these cycles started or finished. I believe this was more to do with the methodology I employed—the case study approach with a series of observations and interviews conducted as the opportunity presented. It may be that observing these cycles of changes would require more deep insider studies, using for examples approaches as 'insider studies' (Coghlan, 2007; Galea, 2009) and/or ethnography (Atkinson & Hammersley, 1998).

The PRDD model has also been developed based on the authors' observations of work settings that comprise a homogeneous work environment, such as a trawler deck and medical advice centre for the maritime industry (Nathanael & Marmaras, 2008a). Construction work, however, is more heterogeneous, with multiple trades, multiple levels and layers between the management and workers. Moreover, many of the works actually done at the 'sharp end of the risk' (Cook et al., 2004) in the construction industry are subcontracted out, so supervisors can play two distinct roles. One of these is as a manager when they implement policies on safety and production, and when they engage and supervise subcontractors on behalf of their employer as a principal contractor. The other is one of workers, when they themselves follow company policies and procedures. This duality of roles may not be directly captured in the PRDD model, and it is up to the researchers to place supervisors of either the 'P' cycle or of the 'RDD' cycle. In my research, I have viewed them as workers, largely because I wanted my data to reflect more of the way work was 'actually done', suggested by authors such as Dekker (2006) and Nemeth (2006). In spite of these limitations, I still believe the PRDD model was useful in seeking to understand the prescription and practice of SWMS in the three organisations I investigated, by allowing me to focus on my research questions.

In the above section, I discussed the utility of the socio-technical systems approach, social construction of safety and the PRDD frameworks for investigating whether SWMS enhance or impede RE as a health and safety risk management strategy. In the next section, I discuss the findings in the contexts of the research sub-questions. I first consider the prescription of SWMS, followed by the practice of SWMS.

7.3 THE PRESCRIPTION OF SWMS

Prescriptions are about an organisation's goals and intentions and expressing these as policies, standards, procedures and/or work instructions (Nathanael & Marmaras, 2008a, 2008b). These, according to the authors, are not expected to be grounded in reality (Nathanael & Marmaras, 2008b) but derived from management and engineering thinking (Schein, 1996), 'communicated downwards as: (i) assigned responsibilities, (ii) specific objectives and (iii) norms, standard operating procedures, task descriptions and physical descriptions of work' (Nathanael & Marmaras, 2008b, p. 111). In this research, I explored the prescription of SWMS through the following research sub-questions.

How are SWMS prescribed, and how is such prescription interpreted?

On a macro level of analysis, the results of this study suggest that the development of the SWMS 'document' can take two main forms of rule development suggested by Hale and Borys (2012a, 2012b), with some differences.

Organisation A, for example, uses a mix of the bottom-up and top-down approach, with the OHS experts playing a significant, mediating role. The bottom-up approach involves obtaining copies of SWMS from the trades, suppliers and customers, while the top-down comes from regulator guidelines, and using this as the basic source of knowledge to develop an initial document. This is then customised in terms of formatting page numbers, and issued as a company-controlled SWMS. There appears to be little flexibility in the way SWMS are developed or implemented, largely because the organisation wants to maintain control over the content and quality.

Some aspects of the prescriptions cycle suggested by Nathanael and Marmaras (2008b) appear to be at play here, including interpretation, rationalisation and, to some extent, reflection-on-process. The interpretation is based on the views of the trades, while the rationalisation appears to involve some level of integration between what customers and/or regulators suggest into the perceptions and understanding of trades. This integration creates an opportunity for some level of trade-offs, in the sense that 'experts' here have to find the fine balance between what will satisfy the customers and suppliers and trades (who supply the materials and labour), against the regulators (who set and enforce the standards). This ground-up approach seeks to suggest the development of the 'document' is a model 2 approach to rules development, suggested by Hale and Borys (2012a). In this case, drawing on the knowledge of trades, customers, suppliers and guidelines suggested by the regulator provides for a number of different cognitive inputs, and so are not be devoid of reality as alluded to by Nathanael and Marmaras (2008b). Such an approach is generally characterised as localised and situated in the specific activities (Hale & Borys, 2012a). However, by setting boundaries around what needs to be included from Organisation A, it also ascribes to a model 1 approach, which means the document is now static and cannot be changed (Hale & Borys, 2012a). Because the 'contents' are most likely to include material from the subcontracted trades, it can become easier to 'enforce' by management. This could cause Organisation A to become brittle (Woods, 2006a) because there is no flexibility around how SWMS are then implemented down the food chain.

In Organisation B, this development appears more to be a top-down approach, hence closely resonates with the model 1 approach suggested by Hale and Borys (2012a). What is different here, however, is a unique, peer review process that includes the OHS experts from Organisation B and a counterpart in the selected trade. This enables SWMS, once developed, to be piloted, road-tested and improved before being issued for use. The document that arises out of this is used as a generic template that can be further customised for use. Here again, some aspects of the prescriptions cycle suggested by Nathanael and Marmaras (2008b) appear to be at play, including interpretation and reflection-on-process. The interpretation involves guidelines from regulator, personal and industry experience, while peer review and road-testing of the document act as opportunities for reflection-on-process. Because the initial development occurs outside of the actual context of work—that is, in an office environment—it provides an opportunity for some level of ROA (Back et al., 2007; Nathanael & Marmaras, 2008a, 2008b).

This would seem to suggest that there is no rationalisation in the prescription of SWMS suggested by Nathanael and Marmaras (2008a, 2008b). However, this may not necessarily be the case because of a unique peer review process that occurs here. In the traditional sense, this type of review involves key personnel from other construction firms visiting the subject construction firm and providing a thorough analysis of current practices and recommendations for improvement (Opfer, 1997). In this organisation, the safety experts are involved with their peer from the contractor's. Whether this is in fact effective or not is unknown. Opfer (1997) himself makes this point, suggesting that peer review was not a magic bullet; with the outcomes dependent on the quality of the reviewer(s) and their efforts.

Compared to Organisation A, there appears to be more flexibility in the development as it is more process focused, and the trades are not expected to conform to a fixed format in as far as the 'document' is concerned. This suggests both a robust yet flexible approach (Back et al., 2007; Nathanael & Marmaras, 2008a, 2008b), hence could enhance RE provided the flexibility filters down the line.

In Organisation C, the development of SWMS also appears be a bottom-up approach. The trades are required to provide a SWMS as part of the tender selection process. This is tantamount to 'interpretation' in the PRDD model (Nathanael & Marmaras 2008a, 2008b). The trades' SWMS are then reviewed using a standard quality assurance checklist, with the hierarchy of controls as an informing device. Two levels of reviews are undertaken, one at higher levels of management (for high risk work) and another at site level (for all other work), before the final document is issued for work; this is tantamount to some degree of reflection-on-process (Nathanael & Marmaras, 2008b). It is possible there is some degree of rationalising as well, especially if the documents are revised from the review process.

The two-level review process used in this organisation can be a way of ensuring robustness in the process; moreover, because there is no preferred 'format' for the final document, there appears to be sufficient level of flexibility for it to be adapted (Nathanael & Marmaras, 2008a, 2008b). This suggests SWMS have the potential to enhance RE in organisation here.

On a micro-level of analysis, the prescription of SWMS, drawn from the views of managers in the three organisations, suggests SWMS are expected to achieve multiple objectives in the three organisations investigated, which are summarised in Table 30.

What is concerning is that the objectives assigned to SWMS by the government and regulator appear, to a large extent, not to be shared by those employed to develop and/or implement health and safety policy in the three construction organisations. This was evident from a comparison of findings at the level of government/regulator (for whom SWMS represented a safe system of work, a live strategy for risk control, a cognitive artefact and a tool for social interactions), the association and managers of the three organisations, who only shared the view that it was a cognitive artefact as well as a tool (Organisation B). This was also evident from the findings relating to the context of work that SWMS are expected to be applied to; the government/regulator suggested these were for (designated) high risk work, while the association and the three organisations extended this to all construction work.

Table 30

The Prescription of SWMS in Three Construction Organisations

Objective of SWMS	Residential Builder A	Residential Builder B	Commercial Builder C
Legal protection	✓		✓
Process for achieving efficiency	✓		
Process of risk assessment			✓
Process of assessing tasks			✓
A Cognitive artefact		✓	
Tool for planning		✓	
Tool for auditing		✓	
Tool for enforcing		✓	
For some construction work only	✓		
For all construction work	✓	✓	✓

However, the views of SWMS held by management in least at two organisations, a domestic and a commercial builder, that they were a form of control, and that they were required for all work, were also held by the association. It appears that this association has a higher degree of influence in terms of how SWMS are perceived in these organisations. It could also appear that the latter view creates conflicting goals for some supervisors and for some workers as well. By imposing it as a control means, supervisors are required to ensure their subcontractors had SWMS for all works and all trades. Moreover, the monitoring efforts of supervisors are aimed more at paperwork, as opposed to monitoring whether work is being done safely. In previous research, Borys (2007, 2009) has suggested the emphasis on paperwork created an 'illusion of safety', and this could be one reason why sacrifices are being made at the level of work being performed, in one case against safety.

7.4 THE PRACTICE OF SWMS

The practice of work, according to Nathanael and Marmaras (2008a), can be decomposed into a series of repetitions (R), distinctions (D) and descriptions (D) loops. On a macro level of analysis, the combined view of supervisors and workers also suggests SWMS are expected to achieve multiple objectives, which are summarised in Table 31.

Table 31

The Practice of SWMS in Three Construction Organisations

Objective of SWMS	Residential Builder A	Residential Builder B	Commercial Builder C
Legal protection	✓	✓	✓
Process			✓
Tool for thinking about hazards		✓	✓
Tool for planning work			✓
For some construction work only	✓	✓	
For all construction work	✓	✓	✓

The most common view is that SWMS provide legal protection, something that was common across all three organisations, and pushed by management in two of the organisations. This is a significant cause for concern. In Victoria, at least, SWMS have not really been the subject of any legal court cases, so precedence on whether this is actually the case has not been set. I believe this is an area that could warrant further investigation. ***More specifically, empirical research on the utility of SWMS to provide legal protection for health and safety is required***.

There is a mixed practice of SWMS as far as the context of work is concerned, with some using it for some work and others using it for all work. According to a recent report, this is a myth, one which has been 'enormously difficult to dislodge', and based on the premise that 'all risks must be managed and *documented* [emphasis added] and have a corresponding SWMS' (Briggs & McCabe, 2012, p. 44). The report goes on to argue that auditors, safety consultants and inexperienced or less qualified safety managers were most likely to perpetrate this myth. In my studies, I believe this view appears to have been influenced more by the association. Two of the safety experts who participated in my study did point to using safety consultants and experts when they were required, suggesting they would seek the assistance of the industry association first. It is possible this view is influenced more by the association. I, however, did not have an opportunity to speak to any safety manager in the commercial organisation, so am unable to say where they were inexperienced or less qualified than those employed in the two residential building organisations.

The practice of SWMS as a tool for thinking about hazards that occur in organisations B and C appears, to some extent, to be influenced by the regulator's view of SWMS as a tool for planning and organising.

On a more micro-level of analysis, I explored the practice of SWMS in the three organisations through a number of research sub-questions relating to the RDD cycles.

To what extent are the practices of SWMS repeated?

In order to be accepted as a way of work, practices have to be repeated (Nathanael & Marmaras, 2008a, 2008b). In all three organisations, SWMS are required for all work. In Organisation B, the SWMS that comes out of the peer review process is generally used as a 'working document', which encourages a process on site, while in Organisation C a new one is required for every job. These observations lend itself to the proposition that some level of repetition suggested by Nathanael and Marmaras (2008a) may exist.

To what extent are the practices of SWMS re-enacted, and how may this be assimilated into a work group?

According to Nathanael and Marmaras (2008a), in order to remain sustainable, work practices need to undergo continuous re-enactment, assimilation and reinforcement. In this research, my way of unpacking these attributes was through a line of questioning aimed at understanding whether SWMS eventually became a way of working. In Organisation A, this appeared not to be the case, while in organisations B and C there was a general tendency to see it as part of normal work. These, combined with the observations that SWMS were mostly used as a 'generic' document in Organisation C, and a requirement for a written SWMS for all work in Organisation C, suggests there is some degree of re-enactment and assimilation in these two organisations.

To what extent are the practices of SWMS reinforced in a work group?

In Organisation A, 95 per cent of the works are covered under a SWMS. Moreover, the findings were that SWMS are generally accepted as ways of working in organisations B and C, and that this involves some form of a process (Organisation C), and were a tool for thinking about hazards (organisations B and C) and for planning work (Organisation C). Combined, this suggests there is some reinforcement of the practices of SWMS across the three organisations.

To what extent are distinctions experienced in SWMS Practice?

Distinctions in practice, according to Nathanael and Marmaras (2008a, 2008b) may be experienced when, after a breakdown, workgroups distinguish new types of situations and/or new ways of working, which trigger RIA and lead to changes to work practice. At the most basic level, I expected such changes to be triggered through any recent incidents, as well as changes in laws and/or policies. In the course of the four months I spent on site, there were two incidents, one of which resulted in an investigation by the regulator. However, this incident did not result in any changes to paperwork in the organisation concerned, except for a re-emphasis on the importance of paperwork. Neither did this incident change the way work was to be done in the future. In another organisation, a recent change in policy associated with SWMS meant all trades were required to supply SWMS. However, this change in policy had been implemented well before I started my project, so I was unable to see if there had been any changes in way the work or processing of SWMS were undertaken.

In the third organisation, there was an incident that was the subject of an internal investigation, and that had resulted in a requirement that safety glasses were compulsory for all work. However, a closer examination revealed that this requirement was already in place (for concreting works), but the requirements were flexibly implemented. Although I did see eye glasses being added onto the list of compulsory PPE on this site, I saw this more as a reinforcement of existing rules associated with safety gear. Again, I am not saying this does not occur; if this occurred I was unable to see any distinct changes in practice in the manner suggested by Nathanael and Marmaras (2008a, 2008b). Even though there were two opportunities for such distinctions to occur in Organisation A (domestic construction) and Organisation C (commercial construction) in terms of an adverse event, I did not observe neither a change in paperwork nor the practice of work. In Organisation C, distinctions through paperwork were initiated; however, I did not see it eventuate during the six weeks I spent on this site.

Because I was unable to identify distinction in SWMS practice, other aspects[39] of such distinctions remained unexplored in my study. I believe this represents a further area of research in relation to SWMS. **More specifically, the extent to which the distinction in the practice of SWMS actually occurs on a construction site is an area that needs further investigation.**

How are the (Informal) Practices of SWMS Formalised by a Work-group and to What Extent Does a Common Description Arise out of This Formalisation?

According to Nathanael and Marmaras (2008a), formalising involved standardising and re-arranging work practices in contexts outside of the usual ways of working. In my research, I sought to understand if this occurred by exploring how work would be done if there were no SWMS, or how an existing SWMS could be modified if people moved from one job to the next, or to another environment altogether. While there were no changes in the documentary aspects of SWMS during the course of my research, some episodes that I observed on the field provided clues as to what happens in practice.

In this research, I observed how groups of workers responded to 'regular threats' (Westrum, 2006) posed by changes to weather conditions. In organisations A and B, roof tilers continued working when there were slight changes in windy conditions. In Organisation B, the team of roof tilers stopped work altogether when it started pouring. On a similar note, the excavation and drains team in Organisation A also continued working when there were slight changes in wind conditions, but stopped work altogether when the wind picked up speed. In these two organisations, the documents used (SWMS and JSAs) did not list things such as 'changing weather conditions', 'rain' and/or 'windy conditions' as 'potential hazards', and neither was any written documentation available to guide the actions of the teams. At the time I concluded my research, the documents had still not been changed to reflect these hazards and actions.

An analysis of these episodes demonstrates that even though there was some level of re-arranging the conduct of actual work, these were not 'formalised', at least not in the manner alluded to by Nathanael and Marmaras (2008a).

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[39] In the context of this project, the aspects I am referring to include breakdown, altering of practice and reflection- in-action identified in the PRDD model (Nathanael & Marmaras, 2008a, 2008b).

Based on the macro- and micro-level of analysis, it is now possible to provide an initial conceptualisation of the prescription and practice of SWMS in the three organisations investigated in this socio-technical system. In all three cases, it appears there are at least two loops involved: one associated with prescription and the other with practice.

In Organisation A this is characterised by a mix of a top-down and bottom-up approach. Some interpretation is involved in both the prescriptions and the practice cycle. There is some element of rationalisation and a reflection-on-process and the final document that is issued is generally regarded as fixed and static, so is expected to be used as part of work. Breakdowns (in terms of incidents) result in an emphasis on the importance of paperwork, thus does not appear to generate new distinctions; the emphasis on paperwork may act to reinforce existing practices. These ideas are captured in Figure 28.

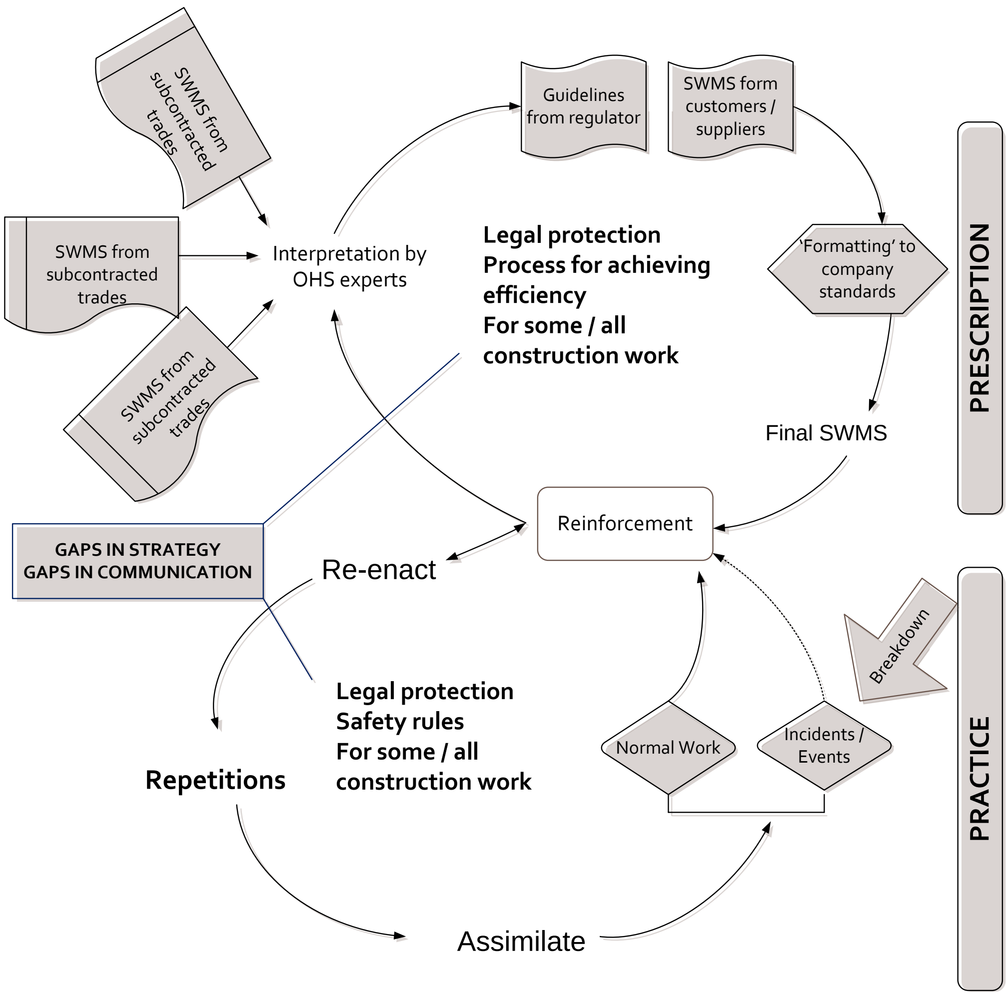

Figure 28: Prescription and Practice of SWMS in Organisation A

In the above figure, I have also indicated that two types of gaps appear in the organisation, including (i) strategy and (ii) communication. In Section 7.4.3, I discuss these gaps further.

Organisation B has more of a top-down approach. The initial interpretation is one of a consolidation and some element of rationalisation, and a peer review process, resulting in a 'working SWMS' that is generally expected to pave the way for planning and interactions necessary to bring about safety on the job. Unlike Organisation A, the final document that is issued is expected to be used more flexibly. A breakdown in terms of incidents provides an opportunity for a review of the document. These points are summarised in Figure 29, where I have also indicted three types of gaps: (i) communications, (ii) perspectives, and (iii) strategy in this organisation.

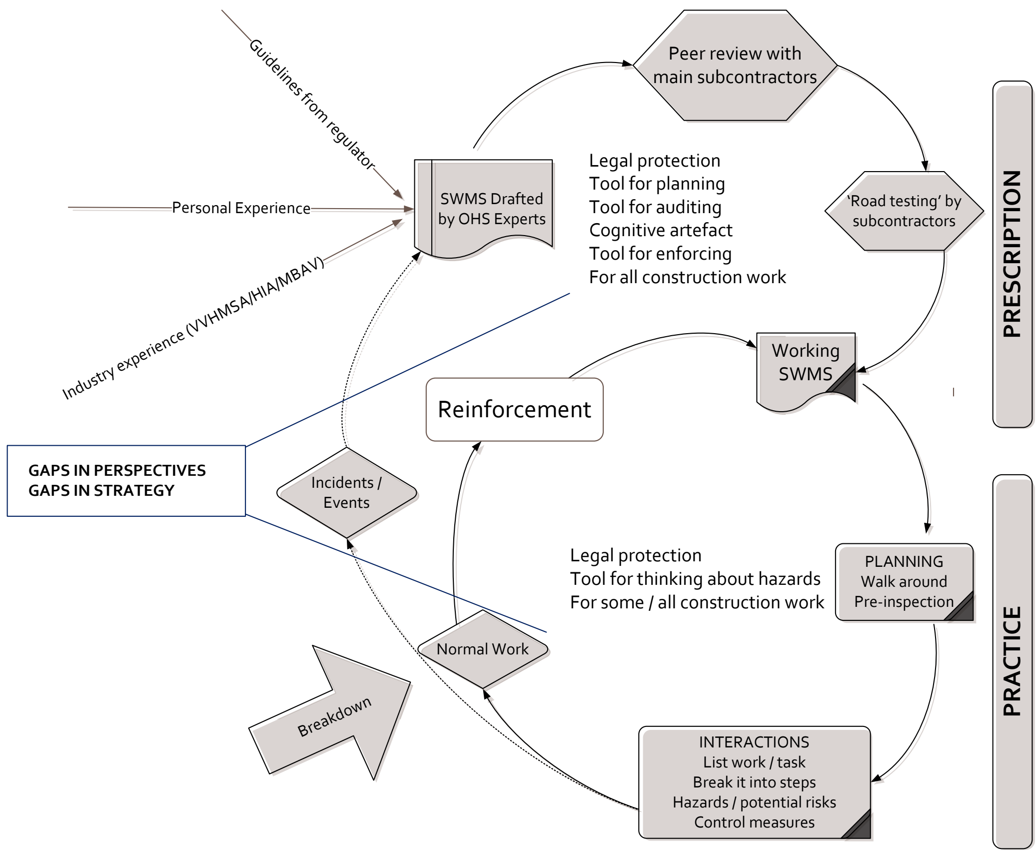

Figure 29: A Prescription and Practice of SWMS in Organisation B

Organisation C has more of a bottom-up approach. The initial interpretation is one of a collection, followed by a two levels of reviews in the prescriptions cycle. These reviews can have one of two outcomes, either a revised document or a finalised document, a copy of which is maintained on file while another is issued for work. Breakdowns, in the form of incidents, trigger a review process that appears to extend to a review of the subcontractors' trades as well. The two levels of reviews in the prescription cycle attempt to deal with 'high risk tasks' and 'normal tasks', but it is unclear whether the reviews following a breakdown take into account whether the task is high risk or not. Figure 30 captures these ideas; again, I have indicated there are gaps in (i) communication and (ii) strategy between the prescription and practice in this organisation.

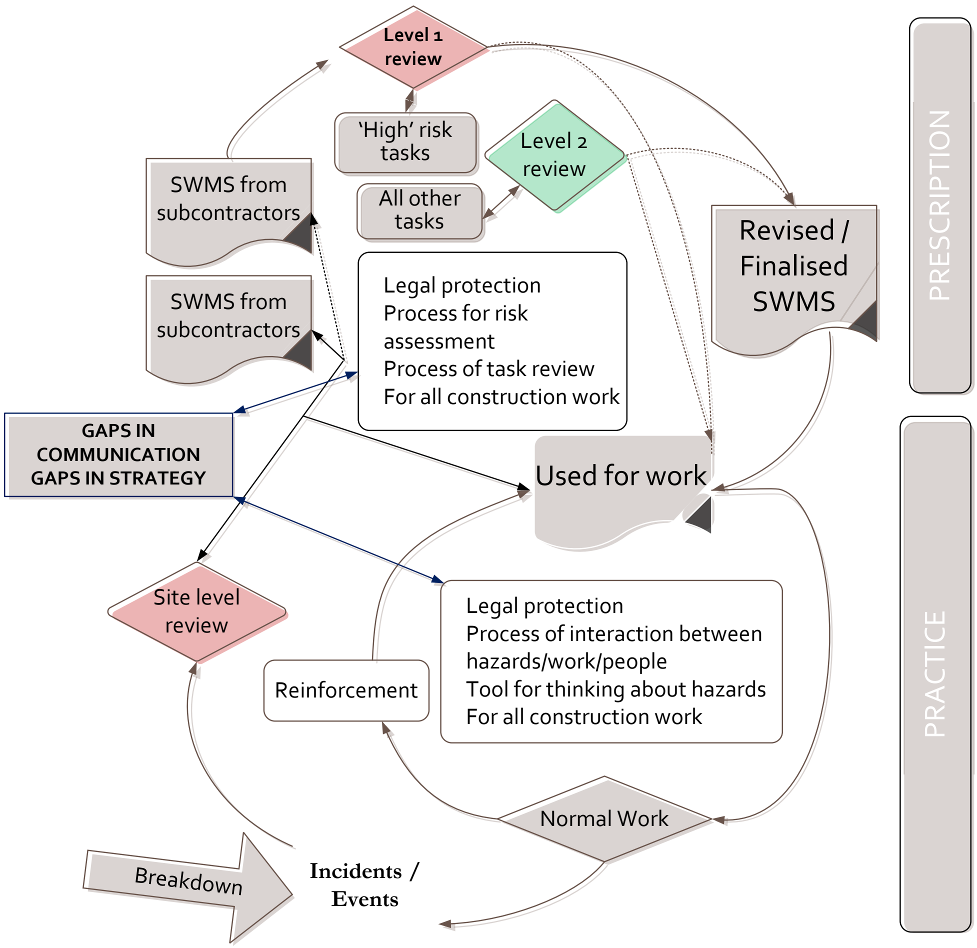

Figure 30: Prescription and Practice of SWMS in Organisation C

As discussed in the results, what appear to be missing from these conceptualisations are the distinctions and descriptions cycles suggested by the PRDD model (Nathanael & Marmaras, 2008a; 2008b). As I have indicated before, this is not necessarily because they may not exist; rather, the methods I used may not have enabled me to observe these cycles in practice.

In the previous section, I discussed the findings relating to the prescription and practice of SWMS across the three organisations. The broad findings go some way towards explaining whether SWMS impede or enhance RE. However, before we can do this, it is equally important to understand the role SWMS play in safety first. This is discussed next.

7.4.1 SWMS AND SAFETY

In seeking to understand the role that SWMS play in safety, I will draw on the results of 'practice of work', which is based on the combined views of supervisors and workers. This is because RE suggests there was a need to be cognisant of 'how work is actually performed' (Dekker, 2006) as opposed to how it is imagined to be performed—that is, prescription of work.

The findings of work as performed suggest that SWMS are expected to play a role in safety in four different ways. One is by virtue of 'working to rule' (Hale & Borys, 2012b; Hale et al., 2003; Hale & Swuste, 1998) as a set of procedures, which was common across all three organisations. This view is built on the assumption that: (i) construction work is static, (ii) all hazards and risks can be identified at the conception stage, (iii) rules and procedures are the best of work of controlling all risks and (iv) standardising human behaviour through the rules and procedures will bring about safety. This understanding resonates most closely as an action rule (Hale & Swuste, 1998). Such an approach, however, has been suggested to dampen the effects of performance variability, and prevents the development of resilience (Hale & Borys, 2012b; Hollnagel, 2011b). Instead, it could increase brittleness (Woods & Hollnagel, 2006) in a system, causing it to collapse when challenged by vulnerabilities that are not covered in the scope of rules or procedures.

The second is by way of a process that encourages thinking about hazards and work (views held in the two residential organisations) and as a process for reviewing the task at hand and the hazards of the job (a view held in the commercial organisation). This closely resembles process rules according to the Hale and Swuste (1998) classification of rules. A process generally requires some level of coordination between the different players, the work and hazards, which is generally facilitated through cognition (in terms of the thinking). According to authors such as Grote (2008) and Grote, Weichbrodt, Gunter, Mezo, and Kunzle (2009), processes are a comprise between standardised and flexible ways of working through the development of routines. In the PRDD model of work, the repetitions-distinctions (RD) cycle has been suggested to lead to the development of work routines, and this is one way of stabilising the way work is done (Nathanael & Marmaras, 2008a, 2008b). Flexibility and stability are associated with organisational routines (Grote, 2008; Nathanael & Marmaras, 2008a); hence, using SWMS in this way can assist in developing organisational resilience.

The third is by SWMS acting as a tool for creating awareness, not only about normal hazards and means of controlling them, but about 'slack resources' (Hopkins, 2009b; Weick & Sutcliffe, 2001, 2007). These slack resources include a pool of additional control measures, which are listed on SWMS documents but not necessarily crossed out. In at least two of the organisations, there was some reference to leaving the control measures on the document itself even though there was no need for them, with the understanding they could be required at some stage of the job. This is preferable under the RE strategy; an awareness of the presence of additional ways of controlling risks does create an opportunity for some re-thinking about what range of strategies are available for use if required.

The fourth and most important role SWMS play is through social interactions, which SWMS are expected to facilitate. Again, the findings of work as performed expressed social interactions in many ways, including engaging, discussion, planning, informing and auditing—views that were aired in all three organisations. Social interactions have also been earlier identified by Gherardi and Nicolini (2002a, 2002b) and Borys (2012) in construction settings, Rochlin (1999) in High-Reliability Theory, and in numerous discussions on safety culture (Hopkins, 2006; Hudson, 2001; Reason, 2008) as playing an important role in creating safety on the shop floor. In RE studies, similar findings have been observed in the petrochemical domain, with the term 'safety conversations' used to describe such interactions (Hansson et al., 2009; p. 737). As the authors posit, this:

> covers all conversations where safety is an issue and the purpose is to enhance the quality of these conversations. When safety issues are treated in a proper way they will increase the knowledge about safety, and clarify *anticipations* [emphasis in original] and what to expect. Safety conversations can also influence *attention* [emphasis in original], e.g. what to look for in terms of hazards in their daily work. One purpose of safety conversations between employees and managers is also to increase the awareness of how to *respond* [emphasis in original] to critical situations. (Hansson et al., 2009, p. 737).

Others, such as Carillo (2011) citing Stacey (2007), posit that what occurs in organisations stem from the interactions that take place between individuals and groups; this also extends to the outcome of safety in organisations.

The findings from the three organisations seek to suggest that there is a significant level of flexibility in the way SWMS are used at the sharp end of risk (Cook at al., 2004) to achieve safety. There is some tendency to use it as a set of rules, and RE theory suggests this could cause organisations to become brittle. However, the other view of SWMS, which suggests it can be used more flexibly by encouraging thinking about work and hazards as a guide for planning and as a tool for facilitating interactions, indicates it could be used to enhance resilience organisations. That is, flexibility in the way SWMS are used is important for enhancing RE.

Using this line of thinking, I can now discuss whether SWMS enhance or impede RE as a health and safety management strategy across the three organisations I investigated.

In Organisation A, managers believe SWMS assist in bringing about safety by acting as a set of rules to be followed, a view that is also shared by a number of supervisors and workers here. In the main, SWMS are used inflexibly in this organisation, so it can be generally concluded that they are more than likely to impede RE.

In Organisation B, managers are of the view that SWMS brings about safety by initiating interactions; supervisors and workers believed this occurred through a combination of risk assessment, an awareness of hazards and working environment. Additionally, for the workers here, SWMS represent a tool that they could use for identifying hazards, and that sets rules to be followed; indirectly, these were also related to safety. There is generally no requirement to adhere to a fixed format of the document. Moreover, there is a peer review process that is used to road test the document, which is used more flexibly in doing work. The approach here is one that is somewhat rigid, yet has sufficient flexibility (Nathanael & Marmaras, 2008b). Hence, it can generally be concluded that SWMS are more than likely to enhance RE here.

In Organisation C, managers are of the view that SWMS brings about safety by initiating reviews of tasks and risks, making people aware of hazards and risks and by functioning as a guide to work; most of these views were shared by the supervisors and workers here. Additionally, for the workers here, SWMS were also associated with ‘conceptual slack’ (Hopkins, 2009b; Weick & Sutcliffe, 2001, 2007), which made people aware of other controls that were available and that could be used. In this organisation, there are two sets of reviews, one of which targets ‘normal’ construction work, while a second, higher-level review considers 'high risk'. This approach is expected to add robustness and rigidity to the process. In addition, there is sufficient flexibility in the system, which could explain why supervisors and workers can use SWMS more widely than assessment and thinking about hazards (Nathanael & Marmaras, 2008b). Hence, it can generally be concluded that SWMS are more than likely to enhance RE here.

7.4.2 FINDINGS RELATED TO THE CENTRAL RESEARCH QUESTION

The responses to the research sub-questions can now be synthesised to provide a response to the central research question: *Do SWMS impede or enhance RE as a health and safety management strategy in the Victorian construction industry?*

The results of my research suggest that SWMS are expected to assist in safety by acting as a set of rules and/or procedures in all three organisations. Previous research suggests, however, that rules and procedures act to dampen performance variability, and this is suggestive that SWMS are more likely to hinder RE as a safety management strategy; in my study, this conclusion can be limited to one organisation only. In the other two organisations, SWMS were used more flexibly for achieving safety, by virtue of their use as a process (for thinking about hazards and reviewing tasks and hazards), and as a tool (for creating awareness of hazards, controls, slack resources and social interactions). Used in these ways, SWMS have the potential to enhance RE. These findings are summarised in Figure 31.

This has significant implications for (i) the development and implementation of organisational and regulatory policy on SWMS, (ii) safety management in organisations, and (iii) training on SWMS, rules and safety management. Before discussing these implications an understanding of the gaps that exists in the three construction organisations is useful.

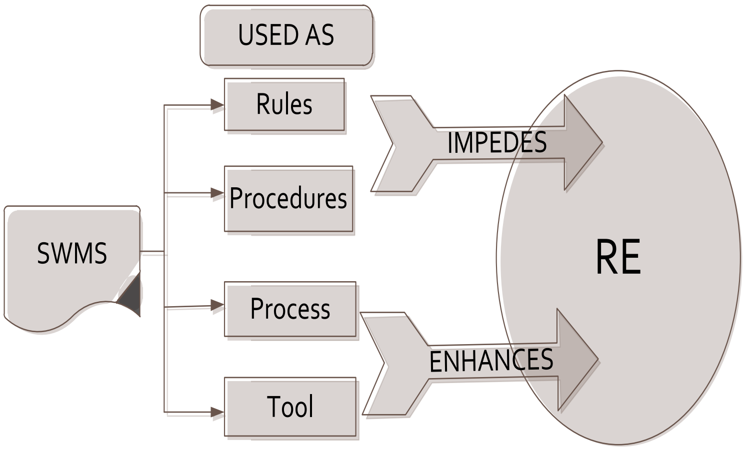

Figure 31: A Theoretical Conceptualisation of Whether SWMS Impede or Enhance Resilience Engineering

7.4.3 'GAPS' IN THE SOCIO-TECHNICAL SYSTEM

In this research, I did not set out to collect data on the nature and types of gaps that existed in the construction socio-technical system. Gaps are nothing new in health and safety because of the practical impossibility of foreseeing, anticipating and designing out unexampled (Epstein, 2008) and irregular (Westrum, 2006) events. Hollnagel (2008b) makes this very point when he argues that 'it is a fact of life that perfect prevention is impossible,…there is always something that will go wrong' (p. 221). In theory, the gap, by itself, may not necessarily be an indicator of resilience or of brittleness; in my view, it is the degree to which people adapt that will provide clues about whether the system (or aspect of that system) is brittle or resilient. Hence, I believe a brief discussion is warranted here.

According to recent research, adapting involves making different types of trade-offs (Hofman & Woods, 2011a, 2011b). In recent years, different classes of gaps have been identified, including: (i) fitness, (ii) plans, models and procedures, (iii) perspectives, (iv) roles/responsibilities and (v) progress (Hofman & Woods, 2011; Woods & Branlat, 2011a, 2011b), while Borys (2012) classified his gaps as: (i) competence, (ii) adequacy and (iii) compliance. In my research, the most prominent gap that appeared to emerge in the socio-technical system was one of perspectives, according to the Hofman and Woods (2011) classification.[40] Citing Morrison et al. (2009) and Woods (2000), the authors argue that such gaps arise because people:

> at any level of abstraction, occupy a point of observations relative to the world they are embedded in, and this relationship defines a perspective. The view from any single point of observation simultaneously reveals and obscures aspects of the world" (Hofman & Woods, 2011, p. 20).

In this study, gaps in perspectives were evident from the fact that the informants were located in the construction socio-technical system. The government and regulators, for example, were located at the top of the system, and their views of what SWMS were expected to achieve were based on meeting the expectations of health and safety law at federal and state levels. The association, who are located at the next level of the system, have an advocacy role—in this case, for building and construction employers—and their views of SWMS are based on what they believe their member organisations should be achieving with SWMS. The views at these levels were completely different, which suggests these two important parts of the socio-technical system are either not communicating, or trying to push two different agendas altogether. What this appeared to create was some level of ambiguity in the construction socio-technical system lower down the line.

This ambiguity was later reflected in the views of the organisational insiders. According to Schein (2003), people's understandings of how things are expected to be are based on where they draw their knowledge from. In the case of engineers and managers, these are the technical or professional institutes they are part of; for supervisors, it is usually their peers, while workers draw from their personal experience. In Victoria, front-line health and safety regulators, as part of their legal enforcement work, interact more closely with supervisors and trades people who are on site, instead of dealing with managers located in head office. These managers, therefore, would tend to rely more on the information provided by the association to which they subscribe as opposed to the supervisors and workers. There was some evidence that the managers' views of SWMS in the three organisations (as legal protection and useful for all construction works) aligned more closely with that of the association (as a form of control and useful for all construction works). However, at the work level,

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[40] I am not saying this is the only gap that exists in the system. There were also gaps in 'fitness' or 'adequacy' and 'cognisance' or 'competence' (Pillay et al., 2012); due to space limitations I have not included them in this thesis.

supervisors and workers had some views that were more similar to the government/regulator, in that SWMS were required for some (not all work), and were a tool for planning and social interactions.

In addition to this gap, I have also identified in figures 28 to 30 two additional gaps, one of which I have labelled as 'communication'. Authors such as Peng and Littleljohn (2001) have identified that communication between the different participants in an organisation plays a central role in maintaining stability and encouraging adaptation. I believe these gaps in communication were evident in at least two of the organisations. Supervisors and workers in Organisation A, for example, appear not have been able to communicate upwards to their managers their view of SWMS as a set of rules, while in Organisation C these groups could not communicate the view that SWMS were used for interacting between hazards, work and people.

These gaps in communication were also evident in the observations that the association and the government/regulator had totally different views about SWMS, and none of the views held by these organisation outsiders appeared to be shared by those involved both in the prescription and the practice of SWMS.

The third gap I have identified is labelled as 'strategy', more specifically 'organisational strategy', and includes the plan, method and/or tools an organisation uses to achieve its goals. In all three organisations SWMS were viewed as providing legal protection at both levels of prescription and practice, which means that all three organisations are likely to spend considerable resources and efforts in achieving this goal. Yet, as I have discussed, the empirical evidence of SWMS providing legal protection does not exist, primarily because SWMS have not been tested in the Victorian courts system. Hence empirical evidence of its ability to provide legal protection does not exist. Therefore using SWMS as a strategy for legal protection represents a gap in strategy in the three construction organisations.

Does the presence of these gaps make the system more brittle than would normally be expected in the construction industry? As discussed previously, there will always be some form of gaps in any system—it is how well people adapt to narrow these gaps that determine whether the system is brittle or resilient. Addressing gaps in perspectives, according to Hofman and Woods (2011), created an invitation for reflection. The authors, however, do not provide a panacea for what such reflection should entail. Dekker (2003, 2006) has suggested that making the gap visible provided the basis for learning and adaptation. To take a step further, I contend that there already exists, across the socio-technical system, a number of strategies and approaches that, if used more expediently, can assist in learning and adaptation.

7.4.4 STRATEGIES FOR ENHANCING RE IN THE SYSTEM

There are currently three key strategies and approaches in the socio-technical system that can be used to enhance RE in the system, including: (i) monitoring by supervisors, (ii) two levels of risk reviews and (iii) using SWMS as cognitive artefacts.[41]

According to Hollnagel (2008a, 2009b, 2011a), an essential key to RE involves knowing what to look for. This requires one to monitor those aspects of an organisation that are, or will, become a threat in the future. Further, he argues that this monitoring needs to include not only the environment but the system itself, and this will assist the system in being prepared to deal with critical issues (Hollnagel, 2008a, 2009b, 2011a). The current strategy of monitoring by the supervisors in the two residential organisations, which includes regular forms of safety audits, is aimed at checking for the presence of paperwork; that is, whether the document actually exists. If one does not exist, trades are helped to develop one, or given a generic one that they can adapt. Safety audits involve detecting and correcting errors, hence are an opportunity for organisational learning (Argyris, 2002). However, if they involve no more than a 'tick and flick' mentality, they do no more than create an 'illusion of safety' (Borys, 2007, 2009) and give a false sense of security that things are right. If there is any learning here, this is most likely to take the form of single-loop learning (Argyris, 2002). I believe it is possible to enhance the monitoring through collaborative cross-checking (Patterson, Woods, Cook & Render, 2007) and encourage double-loop learning (Argyris, 2002).

According to Patterson et al. (2007), 'collaborative cross-checking is a strategy where at least two individuals or groups with different perspectives examine the others' assumptions and/or actions to assess validity or accuracy' (p. 156). These perspectives, according to the

[41] A fourth strategy, used in Organisation B involving a 'peer review' process also sounds appealing, but I was unable to find any recent academic publications on this subject.

authors, can differ on different dimensions such as goals, responsibilities, functions and authority, and the aim of such cross-checks are to detect erroneous assessments or actions. The authors argued that in the short term, collaborative cross-checking was useful in: (i) revealing hidden assumptions, (ii) clarifying trade-offs, (iii) exploring new solutions to satisfy competing goals and (iv) identifying side effects of actions, exceptions and boundary condition, contingencies, information gaps and influences who might support or obstruct plans (Patterson et al., 2007). Similarly, over a longer term, it was useful in: (i) transferring knowledge across different perspectives and (ii) increasing 'meta-knowledge' of others' perspectives (Patterson et al., 2007). This additional pool of knowledge can be a powerful learning tool for learning in the organisation and assist the system to be better prepared to deal with irregular and unexampled threats. In other words, collaborative cross-checking creates an opportunity for double-loop learning in organisations (Argyris, 2002). This, according to the author, allows one to develop a deeper understanding of why errors occurred so that they can be addressed.

Another strategy that exists here is two different types of reviews undertaken in Organisation C. One level is associated with 'high risk' construction tasks, and is a higher-level review by senior management that is undertaken as part of the 'tendering and procurement' stage of a construction project (Swuste et al., 2012), while the second one is undertaken for all other construction tasks. Again, these are currently limited to ensuring the SWMS submitted as part of the tender process meet the quality assurance criteria of the principal contractor. Once engaged, however, collaborative cross-checking can also be used to review the management of safety by the subcontractors by not only focusing on the paperwork but extending this to the quality of controls, frequency of maintenance and inspections of equipment, materials and tools. Used in this expanded way, these reviews will also assist in monitoring and dealing with threats across the life-cycle of the construction work.

A third strategy that is available in the socio-technical system is the view of SWMS being a cognitive artefact (Jones & Nemeth, 2005; Jones & van deer Chisalita, 2005). The idea behind an artefact is that it can amplify the ability to do something. One of the views of the government/regulator was that SWMS encouraged thinking about the whole aspect of the task, materials and resources that were to be used as part of the planning process. As I have suggested, this extends beyond the thinking of normal, everyday hazards and threats, to include irregular ones as well (Epstein, 2008; Westrum, 2006). Organisation B managers had this view that having SWMS encouraged people to stop and think about hazards, while many other informants talked about bringing safety to the forefront. These again, for me, represent enhanced capabilities of SWMS, and these can assist users to be aware of not only regular but also irregular threats as well.

In summary, it can be suggested that while safety audits can be a way of detecting errors and failures in the socio-technical system, collaborative cross-checking can be useful in expanding the pool of knowledge regarding the whole system (instead of single parts or elements of the system). Two levels of risk reviews can also contribute to understanding the whole system better, while using SWMS as a cognitive tool can amplify its ability to extend one's thinking to irregular, even unexampled threats that could affect the construction system. Combined, these strategies can be a very powerful way of encouraging double-loop learning in organisations, narrowing the gaps in perspectives and enhancing RE across the construction socio-technical system.

Central to achieving these, however, is the issue of communication, including the language that is used for conveying messages across the socio-technical system. If management want to communicate the message that SWMS are required for all work, and they emphasise this, it is more than likely this same view will be held by many down the line. Similarly, if the government/regulator communicate in a clear way that SWMS are not about legal protection but more about the whole system of work, there is a possibility this message can be 'heard' better by those it is seeking to influence, and assist the different parts of the socio-technical system to adapt and learn. These ideas are summarised in Figure 32.

In this chapter, I covered the limitations of the study and the utility of the theories I used to inform my thesis, before discussing my findings in relation to the central research question and a series of research sub-questions. Through an analysis of the different perspectives of SWMS that exist in the socio-technical system, I have also identified the major form of gaps that exist in the construction socio-technical system I investigated. I concluded this chapter with approaches and strategies that, if used more expediently, can address this gap. In the final chapter, I draw together my findings to answer the central research question and make some tentative conclusions.

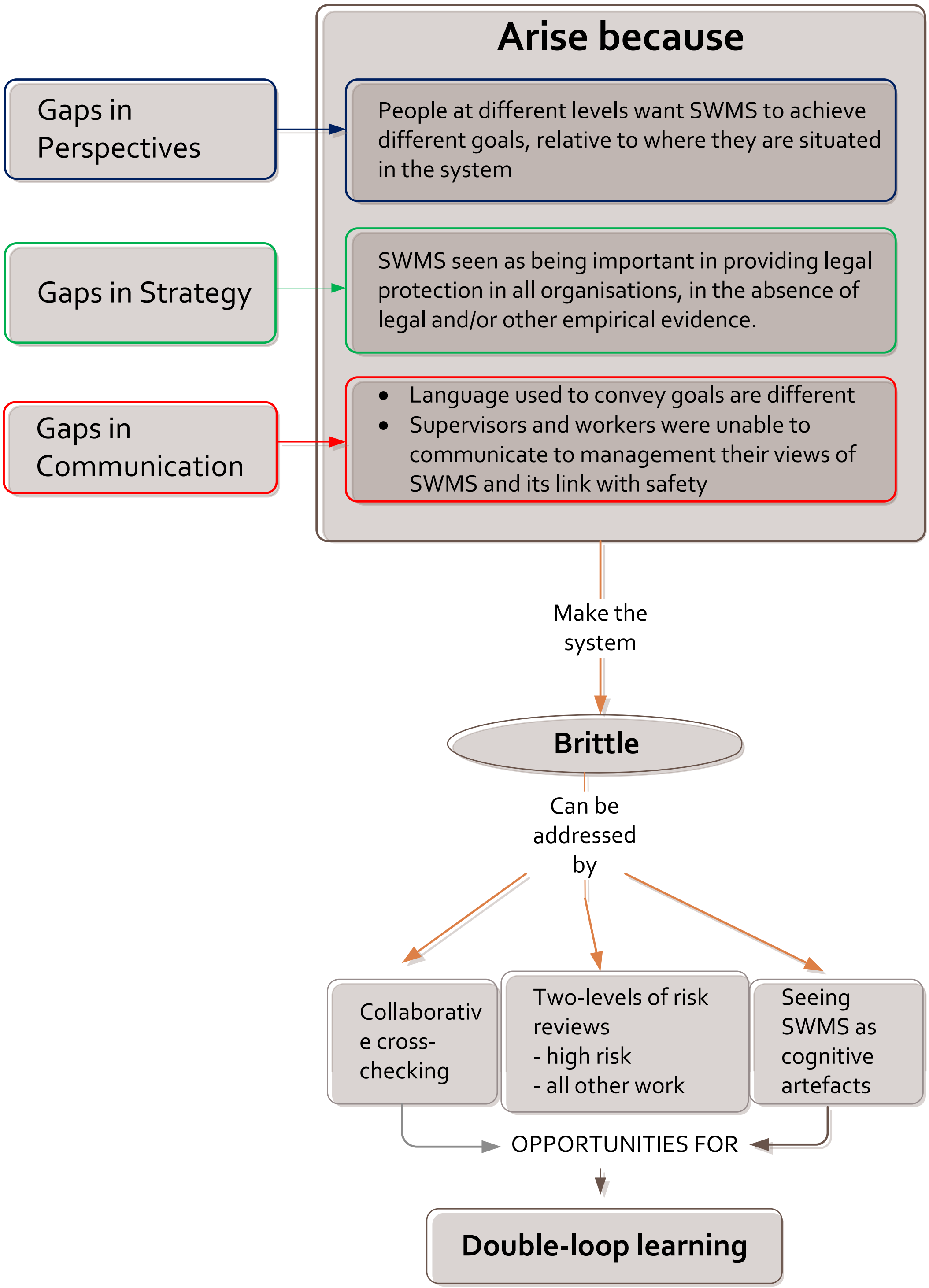

Figure 32: Gaps and Ways of Enhancing RE in the Construction Socio-Technical System

CHAPTER 8: CONCLUSIONS

8.0 REVISITING THE RESEARCH PURPOSE

The purpose of this study was to **develop an understanding of whether SWMS enhance or impede RE as a health and safety management strategy in the Victorian construction industry** by exploring the prescription and practice of SWMS. SWMS have been regulated for the construction industry in Australia; however, there is very little published research on SWMS, so its utility as a health and safety risk control strategy is questionable. RE, which is associated with the adaptive age (Borys et al., 2009), has been touted as the most recent innovation in health and safety management, and this thesis adopts the premise that it offers a complementary approach that could be used to drive health and safety improvements further than what has been achieved in the industry to date (Schafer et al., 2008; 2009).

A review of the literature revealed there is no uniform definition of RE (Dekker, 2006; Sheridan, 2008; Pillay et al., 2010). Hence, there is no single way in which it can be measured and/or assessed. The review also suggests it is a multi-dimensional construct and associated with adaptations that occur at work. On a theoretical level, RE has been conceptualised from both functionalist and interpretive perspectives. The functionalist view, however, appears to be at odds with the essence of RE, which suggests moving away from quantification to achieving a deep insight into how work is actually performed. Therefore, this study has taken the view that the interpretive perspective is more useful for advancing RE research through SWMS. The starting point for my thesis involved the proposition of a working definition for RE.

Based on a review of the literature, I proposed a working definition of RE as *a sophisticated way of managing organisational safety through the development of cognitive, behavioural and cultural abilities to enable organisational members at all levels to actively anticipate, respond, monitor and learn to operate close to the boundary of safe operations as part of normal work, by narrowing the gap between work as imagined and work as performed.* In providing this definition, I asserted that the sophistication in RE is not necessarily to do with new technology, but more to do with how existing tools and strategies could be used in more innovative and interesting ways.

The literature review also revealed that while RE is gaining momentum in a range of different environments, contexts and disciplines, what was lacking was an integration of the ideas into a coherent theoretical framework. Using the literature on the 'gap between work as imagined and work as performed', I developed a conceptual framework for collecting and analysing my data. This framework, supported with an interpretivist paradigm, a constructionist's philosophy embedded within SI, enabled me to capture the meanings assigned to SWMS by the many actors who develop, implement, enforce and/or monitor SWMS in three organisations in the Victorian construction industry. Moreover, theories associated with the systems view of organisations and the social construction of safety enabled me to develop a very good sense of the data I collected through a triangulation of semi-structured, one-to-one and focus group interviews, document analysis and observations. The findings, which are presented and discussed the previous three chapters, present a comprehensive and rich picture of SWMS and RE.

This research was not only timely but also very important. Buildings and structures continue to fall, and employees continue to die at work. While recent years have seen some improvements, achieving higher levels of safety remains an elusive goal: 'it is difficult to concede that with all the technological advances that have been made in the industry, the number of accidents that occur in construction remains higher' (Benford Jr, 2008, p. 1). In Australia, both the federal and state governments have moved to legislate SWMS as a health and safety risk control strategy for the industry, despite the fact that there is very little evidence to suggest they are effective (or otherwise). Moreover, by retaining it as part of the harmonisation of health and safety laws, they have made it clear that SWMS are here to stay. Therefore, any steps taken to advance our understanding of SWMS through empirical research are important if their contribution to improving the safety of the Victorian construction industry is to be realised.

8.1 WHAT THE FINDINGS REVEAL

The central research question this thesis sought to answer was '*Do SWMS enhance or impede resilience engineering as a health and safety management strategy in the Victorian construction industry?*

In seeking to answer this research question, the potential for SWMS to impede or enhance RE as a health and safety management strategy is qualitatively determined by the degree to which SWMS are flexibly used to achieve safety outcomes in the practice of work. In taking this stance, I have followed the lines of thinking of key proponents of RE such as Dekker (2006) and Nemeth (2006), who posit that while one needed to be cognisant of 'work as imagined', it was more important to fully understand 'work as performed'. According to the socio-technical approach I used in this study, 'work as performed' in the three organisations I investigated is akin to the views of supervisors and workers. Based on this line of thinking my study suggests that **SWMS can both impede, as well as enhance, RE as a health and safety management strategy in the Victorian construction industry, depending on how they are conceptualised and used**.

For example, if they are used as a set of rules and/or procedures, they can impede RE by standardising the way people behave when responding to regular hazards or threats. This could leave them unprepared, perhaps unwilling, to respond to irregular threats they may face. Conversely, if there are used as a process or as a tool, there is more flexibility. This, supported with some degree of social interactions, can amplify their use by actively anticipating, monitoring and responding to regular hazards and threats; hence, they enhance RE.

8.2 IMPLICATIONS

The findings of this study, based on an exploration of SWMS across the construction socio-technical system and drawn from government/regulators, managers, supervisors and subcontractors, who are required to either enforce, deploy or use SWMS in construction organisations, revealed that: (i) safety in construction workplaces arises from social interactions, (ii) SWMS encourage or facilitate such social interactions and (iii) SWMS can: (a) enhance RE if used flexibly and (b) impede RE if used purely as a safety procedure and/or rule to control behaviour. These findings have a number of implications for the policy, safety management and training of construction safety management.

8.2.1 IMPLICATIONS FOR POLICY

The combined views of the government/regulator seek to suggest they expect organisations to use SWMS more flexibly (as a safe system of work, a live strategy for risk control, a cognitive artefact and a tool for social interactions). While one of these views appears to resonate with some players in the system, the other views appear to remain shielded, particularly from the association and management of organisations. The inability of the government/regulator to influence the flexible use of SWMS down the line to the association and organisations suggests the lack of a vertical integration of the government's/regulator's views into the construction socio-technical system, as well as the inability to communicate fully the intentions of the SWMS strategy. Combined, these can create ambiguity in the system, and cause the system to become brittle.

One possible way forward for the government/regulator could be to re-examine the language it uses for communicating with its stakeholders. For example, encouraging the use of 'social interactions' instead of 'consultation' and 'training' may be a better strategy to use with the association, managers, supervisors and workers; in a similar manner, using 'collaborative cross-checking' instead of 'inspections' or 'regulatory compliance audits' may be a better way of reaching those elements who are fixated on a compliance approach to safety management. By adopting this approach, they can assist in driving the system in becoming more resilient.

8.2.2 IMPLICATIONS FOR SAFETY MANAGEMENT

SWMS have been retained in the 'harmonised' health and safety laws in Australia, which means they are here to stay. SWMS, however, will not be able to guarantee safety on its own, because it acts more like a 'symbolic barrier' (Hollnagel, 2008b). What this means is those charged with managing safety in construction organisations need to re-examine the way they view and use SWMS. 'Forcing' their own stance regarding SWMS is not likely to effective. For example, if they see SWMS purely as a set of safety rules/procedures for controlling work behaviour, this is more likely to restrict the ways people act and behave, without any significant improvements in safety performance. This approach can also cause their organisations to become brittle.

A better way forward for managers would be to understand how supervisors, workers and subcontractors view and use SWMS in their organisations, acknowledging that there will be some differences because what they want to achieve and what the workers, supervisors and trades may want could be somewhat different. This research has revealed that the differences could also be due to communication down the line. Earlier on, I have suggested that a possible way forward in terms of policy would be to look at the language they are using to transmit the SWMS message, and this also becomes important here. For example, seeing SWMS as a 'tool of the trade' instead of as a 'legal protection', a 'process' instead of a 'rule', and as 'collaborative cross-checks' instead of 'safety auditing', would send a different message altogether. The key focus here, however, should be on the notion that SWMS can be used for doing more than one thing, and the flexibility in how it is used will play an important role in improving safety and enhancing RE in the organisation.

8.2.3 IMPLICATIONS FOR TRAINING

The results of this study suggest that safety in practice is achieved through social interactions in a number of different ways, which have implications for training. Learning about safety and SWMS, in particular in construction settings, is the result of toolbox talks, inductions and experience on the job, and this results in a fountain of knowledge that can be called upon for use. There is a specific requirement for a common 'induction training' to be provided to construction workers. It is at these levels that the multiple and flexible nature of SWMS can be emphasised.

SWMS are expected to achieve safety in at least four ways, one of which is through social interactions and was discussed earlier. Another way is by working to rule (Hale & Borys, 2012; Hale et al., 2003; Hale & Swuste, 1998) as a set of procedures. This is perhaps a predominant view that currently exists in the construction socio-technical system investigated. In addition, they can also bring about safety as a process (Hale & Swuste, 1998) for thinking about hazards and work, and work as a tool for creating awareness, not only about normal hazards and means of controlling them, but also about 'slack resources' (Hopkins, 2009; Weick & Sutcliffe, 2001, 2007) that exist in the system. These are more complex conceptualisations of SWMS, so need to be integrated into the higher education curriculum on construction safety management in order to be fully explored and realised.

8.3 CONTRIBUTIONS

A PhD thesis is expected to make a significant contribution to the field. In Section 2.5.1, I identified five main gaps relating to SWMS and RE.

First, *empirical evidence of the effectiveness (or otherwise) of SWMS and its contribution to health and safety does not exist* (Borys, 2012). This is an empirical study based on an analysis of 64 interviews, 46 documents and six sets of observations. Data collected in this study give an insight into how managers, supervisors and subcontractors in two domestic and one commercial construction organisations prescribe, interpret and use SWMS as part of their normal work. The findings show that SWMS do play a role in bringing about safety in four different ways. This thesis thus adds to the work of Borys (2012), whose research was limited to a single, commercial organisation.

Second, *empirical evidence of the extent to which adaptations actually occur in construction sites is not available* (Saurin et al., 2008). Results from this study suggest there is sufficient flexibility in the construction organisations I investigated for SWMS to be adapted for achieving multiple objectives. Moreover, a number of limited observations seek to suggest there is evidence of some level of episodic adaptations of construction workers to threats such as changing weather conditions. This thesis, therefore, provides some evidence that adaptations do occur, and that these adaptations can be investigated through interviews and observations.

Third, there is a *lack of empirical studies on RE from the construction domain*. This study investigated whether SWMS impede or enhance RE as a safety management strategy in construction. A substantial part of my thesis is built around RE, so contributes to the RE literature from a construction context. In doing so, it advances the work of authors such as Schafer et al. (2008, 2009), Schafer et al. (2009).

Fourth, *existing research in safety management is limited to examining single units or levels of organisations* (Størseth, Albretschsen, et al., 2010; Størseth, Tinmannsvik, et al., 2010). In this study, I utilised a multi-level research design and conceptualised the construction organisations as part of a broader socio-technical system, and this approach enabled me to extend the data collection and analysis beyond the fixed boundaries of the organisation by including subcontractors, the association, government and regulator. I believe this study, therefore, provides a more comprehensive and richer picture of the SWMS phenomena in the industry.

Fifth, *an adequate theoretical framework for examining the gap between work as imagined and work as performed is lacking in the RE literature*. This study primarily builds on the ideas of the gap between work as imagined and work as performed (Dekker, 2006; Hollnagel & Woods, 2006; Nemeth, 2006) as an important facet of RE. The theoretical framework that guided the collection and analysis of data was derived from the PRDD model, a framework developed through empirical research to explain the prescription and practice of work (Nathanael & Marmaras, 2008a, 2008b). It thus provides empirical evidence of the utility of the PRDD model as a framework for researching the gap between work as imagined and work as performed.

On a more broader level, the findings of this study reveal that safety in the Victorian construction industry arises not from following safety rules and procedures but through social interactions; in this regard, it adds to existing knowledge on the social construction of safety advocated by authors such as Gherardi and Nicolini (2002a, 2002b) and Turner and Gray (2009). Combined, this thesis makes a significant contribution to the literature on SWMS and RE by providing empirical evidence that SWMS can both impede as well as enhance RE as a safety management strategy, depending on how it is used in practice.

Most importantly, this research has provided insights into how safety is actually achieved in Australian construction settings. However, it is not merely sufficient to collect data and write about it. It is hoped that this thesis will inspire those seeking to improve health and safety to not shy away from RE but embrace it as an opportunity for understanding work as actually done, in order to drive safety improvements at an organisational level.

8.4 AREAS FOR FURTHER RESEARCH

While this research did address the five main gaps identified in the literature, the findings and discussions suggest there are a number of, as yet, unexplored areas in relation to SWMS.

1. *The philosophical basis for the designation of high risk work by the government/regulator is missing* (see Section 5.1.3), and addressing this is an important first step in understanding the role SWMS play in improving safety in the industry.

2. Many informants perceived that SWMS provide legal protection; however, SWMS have not been the subject of many court cases (see Section 7.4*). Hence, empirical*

research on the utility of SWMS to provide legal protection (or otherwise) for health and safety is required.

3. In as far as the practice of SWMS is concerned, it was difficult to decipher the distinctions cycle suggested in the PRDD model (Nathanael & Marmaras, 2008a). *Hence, the extent to which distinctions actually occur in SWMS practice in construction work is an area that needs further investigation.*

4. On a more global level, this research has revealed a diversity of views regarding what SWMS are expected to achieve in Victoria. *However, how widely these views are shared across the broader construction socio-technical system is unknown, and empirical research is necessary to test these findings further.*

I believe that addressing these areas of research is an important step towards realising the potential benefits of the SWMS strategy.

8.5 CONCLUDING REMARKS

Work-related incidents and fatalities place significant economic and social costs on Australian society, and these are expected to increase in the future. The construction industry is of particular concern in this regard because it is not only one of the most hazardous and dangerous for workers, but is also complex. Any steps taken to improve health and safety will go a long way towards improving the quality of the working life of the workers. This research has attempted to contribute to this debate by exploring applications of SWMS in a practical way, by exploring whether they impede or enhance RE in construction organisations. In doing so, it builds on the theoretical ideas of a systems view of organisations and the social construction of safety. This research has made a positive contribution to worker safety by highlighting the importance of understanding work and safety in construction from the perspective of subcontractors and supervisors. **Understanding this work as performed is (i) a critical first step in enhancing RE through SWMS, (ii) important for effective deployment and communication of the SWMS strategy, and (iii) an opportunity for developing the capacity of construction company operators and workers to manage OHS more effectively.**

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APPENDICES

Appendix 1

University of Ballarat Human Research Ethics Committee Approval

Approval

Human Research Ethics Committee

University of Ballarat
Learn to succeed

Principal Researcher:	David Borys
Other/Student Researcher/s:	Dennis Else Manikam Pillay
School/Section:	Science & Engineering
Project Number:	A10-127
Project Title:	Safe work method statement: Their contribution to risk control in the Australian construction industry
For the period:	26/11/2010 **to** 30/06/2013

NB: External approvals must be submitted before recruitment and data collection can begin.

Please quote the Project No. in all correspondence regarding this application.

REPORTS TO HREC:

An annual report for this project must be submitted to the Ethics Officer on:
26 November 2011
26 November 2012
www.ballarat.edu.au/ard/ubresearch/hdrs/ethics/humanethics/docs/annual_report.doc

A final report for this project must be submitted to the Ethics Officer on:
30 July 2013
www.ballarat.edu.au/ard/ubresearch/hdrs/ethics/humanethics/docs/final_report.doc

Ethics Officer
26 November 2010

If any changes are to be made to this project, a 'Request for Amendments' form must be completed and forwarded to the Ethics Officer for approval.

Appendix 2

University of Ballarat Human Research Ethics Committee Final Project Report

Final Project Report
Human Research Ethics Committee

University of Ballarat
Learn to succeed

1) Project Details:

Project No:	A10-127
Project Name:	Exploring Resilience Engineering Through The Prescription and Practice of Safe Work Method Statements in the Victorian Construction Industry

2) Principal Researcher Details:

Full Name:	Dr David Borys
School/Section:	School of Health Sciences / VIOSH
Phone:	53279159
Fax:	
Email:	d.borys@ballrat.edu.au

3) Project Status:

Please indicate the current status of the project:	
☒ Data collection complete **Completion date: 30 / 11/ 2012**	☐ Abandoned **Please give reason:**

4) Special Conditions:

If this project was approved subject to conditions, were these met?		
☒ N/A	☐ Yes	☐ No *** NB: If 'no', please provide an explanation:**

5) Changes to project:

Were any amendments made to the originally approved project?	
☐ No	☒ Yes *** NB: Please provide details:** We extended the interviews to an additional group, regulators of health and safety. Written consent for this was achieved prior to the collection of data.

6) Storage of Data:

Please indicate where the data collected during the course of this project is stored:
On a laptop computer that is only currently accessible to the PhD candidate. Printed copies are also maintained in a locked up cabinet.

7) Research Participants:

Were there any events that had an adverse effect on the research participants?	
☒ No	☐ Yes *** NB: Please provide details:**

8) Summary of Results:

8.1. Please provide a summary of the results of the project:

Health and safety experts are largely responsible for the development of SWMS at these organisations, with managers and supervisors playing a minimum role. As prescribed SWMS are expected achieve a number of different objectives, including legal protection, acting as a process, and as a tool, and bring about safety as a set of rules, guidelines or procedures. The practices of SWMS are generally aimed at meeting a number of objectives, some of which are similar to prescriptions and some of which are different. For example, at the supervisors' level they are expected to provide legal protection, and assist in achieving safety through interactions on site.

The results show different types of gaps that exist in the three organisations and across the system. The more common of this one of perspectives which arises because people at different levels of the system see and use SWMS based primarily on what it means to them. There were also gaps in adequacy and/or fitness, cognisance and/or competence; and roles/responsibilities. These gaps have the potential to make the construction socio-technical system brittle.

A number of strategies are used to manage SWMS in the three organisations investigated, such as auditing, two levels of risks reviews, and a 'unique' peer review process. In addition, a unique view of SWMS as a 'cognitive artefact' also exists in two parts of the socio-technical system. I strongly believe such flexibility in the way SWMS are used can be a useful way of enhancing RE as a health and safety management strategy, provided they are supported with social interactions on site.

8.2. Were the aims of the project (as stated in the application for approval) achieved? Please provide details.

The aim of this research was to build an understanding of SWMS and its contribution to health and safety risk control in the Australian construction industry. This aim has been achieved because the research suggests SWMS, whilst being a complex phenomenon, does play a role in bringing about safety in the practice of work by (i) acting as a set of rules, or procedures, (2) as a tool for thinking about and planning for hazards, risks and means of controlling them, (3) as a guide for creating awareness about safety and as a form of 'redundancy' and (4) through social interaction.

During the course of the project the purpose of the project was revised to understand whether SWMS enhance or impede RE as a health and safety management strategy. This objective has also been achieved because this research has demonstrates SWMS can impede RE if it is used only as a set of rules and procedures because this was likely to restrict people's ability to adapt; but enhance RE if it was used more flexibly, and supported with social interactions on site.

9) Feedback:

The HREC welcomes any feedback on:

- **difficulties experienced with carrying out the research project; or**
- **appropriate suggestions which might lead to improvements in ethical clearance and monitoring of research.**

The main difficulties in planning and conducting research were earlier highlighted in the annual reports of 2011 and 2012. One, there were difficulties in gaining written approvals and access to construction research sites, including the construction works at the University of Ballarat – there was significantly more paperwork required to be completed even before discussions with the research sites could be held. Two, there were significant delays between getting the ethics approval and getting access to research sites. We believe the requirement to get written approval from research sites such as construction (and other similar industries) may require a rethink.

Outside of the issues discussed in the original ethics application, the candidate also encountered a number of ethical dilemmas during recruitment and the writing stages.

In terms of recruitment, because most construction work is subcontracted out, with people paid for hours they spent on a job, many do not have the ability to make time for interviews because they are unpaid for this time, even if they wanted to have a say. Because these interviews take between 45 minutes to an hour, we believe financial reimbursements or inducements will not be an unethical practice for such group of participants, and guidance on reimbursement of participants should be more flexible.

At the writing stage the PhD candidate did face an ethical issue associated with the 'voice' of the participant – in all about 64 participants were interviewed. The ethical issue here was how many of them would actually be 'heard' in the final document. The selective use of excerpts could well mean some views are overrepresented, some under-represented and some views not represented at all. We believe this area is an under-researched area.

Final Project Report
Human Research Ethics Committee

University of Ballarat
Learn to succeed

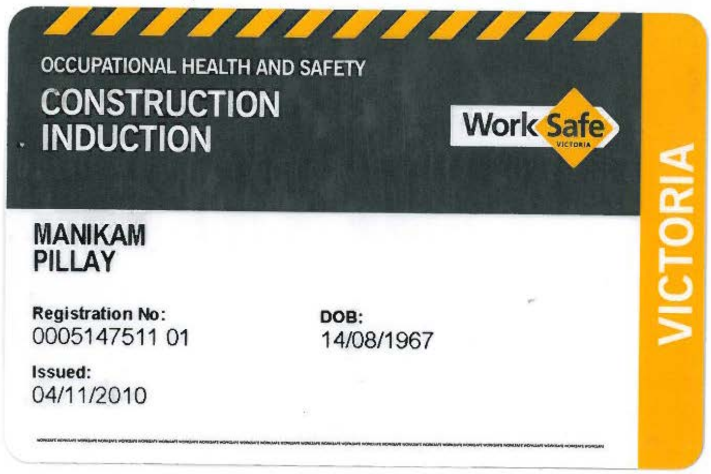
(i) **Signature/s:**

Principal Researcher:	.... Print name: DAVID BORYS	**Date:**	28/2/13
Other/Student Researchers:	... .Pillay....................... Print name: MANIKAM PILLAY	**Date:**	28/2/2013

Please return to the Ethics Officer, Mt. Helen campus, as soon as possible.

Appendix 3

Copy of White Card



Appendix 4

Interview Guide – Regulators

University of Ballarat
Learn to succeed

SCHOOL OF SCIENCE AND ENGINEERING

PROJECT TITLE:	Safe work method statements: their contribution to risk control in the Australian construction industry
PRINCIPAL RESEARCHER:	Dr David Borys
OTHER/STUDENT RESEARCHERS:	Prof Dennis Else Manikam Pillay

Thank you very much for being here. I am currently undertaking a research project examining the role that safe work method statements play in controlling health and safety risks in the Australian construction industry. I will be collecting and reviewing some documents, making some field observations and conducting interviews on a one-on-one basis or as a group. You have been purposefully selected for this interview because of your involvement in enforcing safe work method statements in the Victorian construction industry, so your contribution is central to my research. Attached are a PLAIN LANGUAGE INFORMATION SHEET and a PARTICIPANT CONSENT FORM which I need you to read, sign and date if you agree to participate.

Introductory Questions	
1A. Your Name?	
1B. Your age	
1C. Your position	
1D. Education / training / qualifications?	
1E. How long have you worked in construction?	
1F. How long have you worked for this organisation?	
Transition Questions	
2. Tell me about your experience with safe work method statements?	Probe

Appendix 4

Core Questions	
3A. What, in your view, is a SWMS designed to achieve?	Probe
3B. How do you think SWMS achieve this?	
3C. Where does this understanding come from?	Probe
4. Think about / reflect on the most recent SWMS you worked with.	
4A. What influenced this SWMS?	Probe
4B. How well did this SWMS meet the above objective?	
5. Think about a recent SWMS you used which did not meet the above objective.	
5A. What occurred on this occasion?	Probe
5B. Discuss any lessons you think were learnt?	
6.What do you draw upon to assess and/or verify that a SWMS is doing what it is supposed to do?	
7. With respect to SWMS you deal with regularly:	
7A. To what extent do actual site practices reflect the written SWMS?	Probe
7B. What do you do when you find such site practices?	
7C. What do you draw upon to make the decisions above?	
8. Do you think there anything else that is important in gaining an understanding of how safe work method statements are used and interpreted in construction?	
Participating in this research	
9. Please share your feelings and thoughts about participating in this research.	

Thank you for your time and for your contributions. Your responses will be collated and analysed as part of my thesis, which will be publicly available once it has been examined, I'll let you know when that has happened. Your organisation may also want to know about my findings, and you may be invited to these presentations.

Appendix 5

Interview Guide – Managers

University of Ballarat
Learn to succeed

SCHOOL OF SCIENCE AND ENGINEERING

PROJECT TITLE:	Safe work method statements: their contribution to risk control in the Australian construction industry
PRINCIPAL RESEARCHER:	Dr David Borys
OTHER/STUDENT RESEARCHERS:	Prof Dennis Else Manikam Pillay

Thank you very much for being here. I am currently undertaking a research project examining the role that safe work method statements play in controlling health and safety risks in the Australian construction industry. I will be collecting and reviewing some documents, making some field observations and conducting interviews on a one-on-one basis or as a group. You have been purposefully selected for this interview because of your involvement in writing, training others, using and/or revising safe work method statements, so your contribution is central to my research. Attached are a PLAIN LANGUAGE INFORMATION SHEET and a PARTICIPANT CONSENT FORM which I need you to read, sign and date if you agree to participate.

Introductory Questions	
1A. Your Name?	
1B. Your age	
1C. Your position	
1D. Education / training / qualifications?	
1E. How long have you worked in construction?	
1F. How long have you worked for this organisation?	
Transition Questions	
2. Tell me about your experience with safe work method statements?	Probe

Appendix 5

Core Questions	
3A. What, in your view, is a SWMS designed to achieve?	Probe
3B. How do you think SWMS achieve this?	
3C. Where does this understanding come from?	Probe
4. Think about / reflect on the most recent SWMS you worked with.	
4A. What influenced this SWMS?	Probe
4B. How well did this SWMS meet the above objective?	Probe
5. Think about a time when you provided a SWMS to your supervisors, but which they were unable to use if it was followed; or	Probe
5A. Think about a recent SWMS you used which did not meet the above objective.	
5B. What occurred on this occasion?	Probe
5C. Were any lessons learnt?	Probe
6.Think about any work-related incident which occurred, and which was the subject of a SWMS?	
6B. What did you do?	Probe
6C. Any lessons learnt?	Probe
6D. How were any lessons learnt incorporated into other SWMS you developed and/or deployed?	Probe
7. Do you think there anything else that is important in gaining an understanding of how safe work method statements are used and interpreted in construction?	
Participating in this research	
8. Please share your feelings and thoughts about participating in this research.	

Thank you for your time and for your contributions. Your responses will be collated and analysed as part of my thesis, which will be publicly available once it has been examined, I'll let you know when that has happened. Your organisation may also want to know about my findings, and you may be invited to these presentations.

Appendix 6

Interview Guide – Supervisors

University of Ballarat
Learn to succeed

SCHOOL OF SCIENCE AND ENGINEERING

PROJECT TITLE:	Safe work method statements: their contribution to risk control in the Australian construction industry
PRINCIPAL RESEARCHER:	Dr David Borys
OTHER/STUDENT RESEARCHERS:	Prof Dennis Else Manikam Pillay

Thank you very much for being here. I am currently undertaking a research project examining the role that safe work method statements play in controlling health and safety risks in the Australian construction industry. I will be collecting and reviewing some documents, making some field observations and conducting interviews on a one-on-one basis or as a group. You have been purposefully selected for this interview because of your involvement in writing, training others, using and/or revising safe work method statements, so your contribution is central to my research. Attached are a PLAIN LANGUAGE INFORMATION SHEET and a PARTICIPANT CONSENT FORM which I need you to read, sign and date if you agree to participate.

Introductory Questions	
1A. Your Name?	
1B. Your age	
1C. Your position	
1D. Education / training / qualifications?	
1E. How long have you worked in construction?	
1F. How long have you worked for this organisation?	
Transition Questions	
2. Tell me about your experience with safe work method statements?	Probe

Appendix 6

Core Questions	
3A. What, in your view, is a SWMS designed to achieve?	Probe
3B. How do you think SWMS achieve this?	
3C. Where does this understanding come from?	Probe
4. Think about / reflect on the most recent SWMS you worked with.	
4A. What influenced this SWMS?	Probe
4B. How well did this SWMS meet the above objective?	Probe
5. Think about a time when you were provided with a SWMS for a particular activity, but which your workers were unable to use if it was followed; or	Probe
5A. Think about a recent SWMS you used which did not meet the above objective.	
5B. What occurred on this occasion?	Probe
5C. Were any lessons learnt?	Probe
6.Think about any work-related incident which occurred, and which was the subject of a SWMS?	
6B. What did you do?	Probe
6C. Any lessons learnt?	Probe
6D. How were any lessons learnt incorporated into other SWMS you developed and/or deployed?	Probe
7. Do you think there anything else that is important in gaining an understanding of how safe work method statements are used and interpreted in construction?	
Participating in this research	
8. Please share your feelings and thoughts about participating in this research.	

Thank you for your time and for your contributions. Your responses will be collated and analysed as part of my thesis, which will be publicly available once it has been examined, I'll let you now when that has happened. Your organisation may also want to know about my findings, and you may be invited to these presentations.

Appendix 7

Interview Guide – Workers/Operators

SCHOOL OF SCIENCE AND ENGINEERING

PROJECT TITLE:	Safe work method statements: their contribution to risk control in the Australian construction industry
PRINCIPAL RESEARCHER:	Dr David Borys
OTHER/STUDENT RESEARCHERS:	Prof Dennis Else Manikam Pillay

Thank you very much for being here. I am currently undertaking a research project examining the role that safe work method statements play in controlling health and safety risks in the Australian construction industry. I will be collecting and reviewing some documents, making some field observations and conducting interviews on a one-on-one basis or as a group. You have been purposefully selected for this interview because of your involvement in writing, training others, using and/or revising safe work method statements, so your contribution is central to my research. Attached are a PLAIN LANGUAGE INFORMATION SHEET and a PARTICIPANT CONSENT FORM which I need you to read, sign and date if you agree to participate.

Introductory Questions	
1A. Your Name?	
1B. Your age	
1C. Your position	
1D. Education / training / qualifications?	
1E. How long have you worked in construction?	
1F. How long have you worked for this organisation?	
Transition Questions	
2. Tell me about your experience with safe work method statements?	Probe
Core Questions	
3A. What, in your view, is a SWMS designed to achieve?	Probe

Appendix 7

3B. How do you think SWMS achieve this?	
3C. Where does this understanding come from?	Probe
4. Think about / reflect on the most recent SWMS you worked with.	
4A. What influenced this SWMS?	Probe
4B. How well did this SWMS meet the above objective?	Probe
5. Think about a time when you were provided a SWMS by your supervisor, but which you were unable to use if it was followed; or	Probe
5A. Think about a recent SWMS you used which did not meet the above objective.	Probe
5B. What occurred on this occasion?	Probe
5C. Were any lessons learnt?	Probe
6.Think about any work-related incident which occurred, and which was the subject of a SWMS?	
6B. What did you do?	Probe
6C. Any lessons learnt?	Probe
6D. How were any lessons learnt incorporated into other SWMS you developed and/or deployed?	Probe
7. Have you had any recent experience with job you did which was not the subject of a SWMS?	Probe
7A. What happened?	Probe
7B. To what extent did the work practices you used become part of a new SWMS / way of woking?	Probe
8. Do you think there anything else that is important in gaining an understanding of how safe work method statements are used and interpreted in construction?	
Participating in this research	
9. Please share your feelings and thoughts about participating in this research.	

Thank you for your time and for your contributions. Your responses will be collated and analysed as part of my thesis, which will be publicly available once it has been examined, I'll let you know when that has happened. Your organisation may also want to know about my findings, and you may be invited to these presentations.

Appendix 8

Initial Coding List

Code	Description	Where is This Derived From
Rationalise	Alluding to behaviour or action	Prescriptions loop in the PRDD Model
Reflection-on- process	Alluding to some level of thinking	
Prescribe	Alluding to some aspect of writing or development	
Assimilate	Alluding to consolidation	Repetitions loop in PRDD model
Reinforce	Alluding to some aspect of continuous doing	
Re-enact	Alluding to some aspect of repeated actions	
Normal	Alluding to something that is part of the norm.	
Abnormal	Alluding to something that is outside the domain of the norm.	Transition From Reps to Distincts. in the R-D loop
Breakdown	Alluding to onset of changes	Distinctions loop in the PRDD model
Alter practice	Alluding to change in work practice, not necessarily in documentation	
Reflection-in-action	Alluding to changes in the course of work	
Reflection-on-action	Alluding to changes following work	Descriptions loop in the PRDD model
Formalise	Alluding to developing a common understanding	
Learning	Knowing what has happened	Hollnagel's cornerstones of RE
Responding	Knowing what to do	
Monitoring	Knowing what to look for	
Anticipating	Knowing what to expect	

Appendix 9

Example of Second Cycle Coding as Applied to an Extract of Manager Interview

Question relating to prescription of SWMS.

PAR023

For me Safe Work Methods Statements is very much around the process so there is two parts to it, as I tell people. The first part is the, well I suppose one part is the documentation, right the documentation for me is purely worked the same as like a prompt sheet to assist people to, I suppose think through the process, identify hazards and risks and it is very much a prompt, it serves as a prompt sheet for someone. It is like if I ask you to walk into a room and say 'hey let's have a look at some hazards.' In an unfamiliar environment, even if it is a familiar environment, sometimes without some guidance or getting your mind working again in that framework, it can be difficult just to get that thinking working so Safe Work Methods Statement has the advantage or is a great tool to assist people through that process. It also serves as an audit tool as well and that is probably where for me, for the most part, what the Safe Work Methods Statement as a document sits.

As a document the SWMS is an audit tool, and a prompt sheet, for identifying hazards, and for initiating interactions (discussions) in teams.

In saying that, I have never seen a document stop someone getting hurt. So the other key component of completing the Safe Work Methods Statements is I suppose, its practical implementation and it really sits around the discussion, so the discussion you have with your team. If you are working in a team it is discussion that you have with other people or people on site, whether people on trades, it is that communication, so it is that physical interaction. That is what stops people getting hurt because they are actually now connecting or having a real sort of ... I suppose we are taking ownership of the process rather than just sitting because anyone can sit in a vehicle and just tick some boxes, you know, 'great I have completed the document.' I have got to say for the most part, that is probably where we are at in a lot of cases and also in other cases you have a good percentage or a growing percentage of trades now that are starting to see the value in it.

It is slow but it is starting to happen in some areas.

So I suppose working through that cultural change of an industry and people. I think the key to anything like this is about getting the person to see value in it. If they see value in it and the process and can see the benefits then they will start to own it and work the process as it is intended. So there is always that phase that you need to work through, certainly we have got probably a lot of just doing the paperwork, and we have got a small percentage of people that are doing it and see the value in it and are starting to take it up.

This view of an OHS expert suggests that SWMS is both a process and a document. This to some extent reflects earlier ideas of SWMS being a process that is designed to achieve all or any one of the three things suggested by Hale…

The process, according to this view, serves a number of purposes for different people.

One process involves identifying hazards and risks.

Another process may entail auditing, or monitoring according to Hollnagel (2009).

There is an acknowledgement here that SWMS by themselves do not prevent injuries….

Is it possible that written SWMS that use a tick and flick approach may create a culture of just that, an 'illusion of safety' (Borys, 2009).

This point has also been made by an industry association - there is currently a slow uptake of SWMS within the residential housing section .

An inference to culture playing an important role in SWMS.

The value proposition of SWMS?

Are trades likely to see this value?

Appendix 10

Regulator Examples of Designated High Risk Construction work

(WorkSafe Victoria, 2008a, 2008b)

High risk construction Work	Examples
Construction work where there is a risk of falling more than 2 metres	*Installing an evaporative cooler on the roof of a double storey-building.* *Installing an evaporative cooler on a roof* *Retiling a roof* *Constructing a balcony*
Construction work on telecommunication towers	*Installing equipment on a telecommunications tower*
Construction work involving demolition	*Knocking down load-bearing walls as part of a warehouse conversion* *Knocking down a load-bearing wall in a house* *Demolishing a shed or garage*
Construction work involving the removal or likely removal disturbance of asbestos	*Removing floor tiles containing asbestos as part of a building or house refurbishment* *Cutting or drilling into asbestos cement sheet wall*
Construction work involving structural alterations where some sort of temporary support will be used to prevent the structure from collapsing	*Using props to support a ceiling where load-bearing wall will be removed*
Construction work involving a confined space	*Connecting a new sewer to an existing sewer main in a 3-metre trench* *Refurbishing the inside of an oil storage tank*
Construction work involving a trench or shaft deeper than 1.5 metres	*Laying or repairing pipes and conduits in a 2-metre trench* *Testing drainage pipes in a 2-metre trench*
Construction work involving a tunnel	*Building a tunnel in the course of constructing an underground railway or road*
Construction work involving the use of explosives	*Blasting in preparation for the construction of a building or road* *Breaking up rock during construction of foundations*
Construction work on or near: • pressurised gas distribution mains or	*Working near overhead or underground power lines* *Construction work that involves drilling into a wall where live electrical wiring may be present*

piping • chemical, fuel or refrigerant lines, or electrical installations or services.	*Excavating near an existing gas pipe*
Construction work in an area that may have a contaminated or flammable atmosphere	*Demolishing a petrol station and removing old tanks* *Decommissioning plant and removing pipework that may contain residue of hazardous substances*
Construction work involving tilt-up or precast concrete	Building a factory using tilt-up panels Installing a precast drainage pit Building housing units using precast concrete panels
Construction work on or next to roads or railways that are in use	Breaking up and replacing a footpath alongside a roadway that is in use Building a footbridge over an operational rail line
Construction work at a workplace where there is any movement of powered mobile plant	Working in an area of a construction site that is not isolated from • skid steer loaders, • telehandlers, • backhoes, • mobile cranes, • trucks, or • truck-mounted concrete placing booms
Construction work in an area where there are artificial extremes of temperature	Construction work in an operating cool room or freezer Construction work alongside an operating boiler
Construction work in, over or near water or other liquids if there is a risk that someone may drown	Constructing a bridge over a river Restoring a wharf Building a second-storey extension next to a swimming pool Building a gazebo adjacent to a swimming pool
Construction work involving diving	*Divers undertaking structural repairs to a jetty, pier or marina*